

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Inventory is one the most important item of current assets remained with any business firm which refers to the goods and materials used by a firm for the purpose of production and sales. There are three basic types of inventory: raw materials, work-in-process and finished goods. Raw material is the items purchased by firm for use in production of finished product. Work-in-process consists of all items currently in the process of production. These are actually the partly manufactured products. And finished goods consist of those items, which have already been produced but not yet sold.

In any business firm there is significant role of inventory management on management. Most of the company consists of up to 60% as inventory i.e. large amount of fund have been invested in inventory. So, it must be considered that proper management of inventory methods, techniques as much as possible to achieve the predetermined objectives of the firm. There is no doubt that the company which ignores the role of inventory which management ultimately declines in today's competitive market. Inventory management plays great role in continuous run organization. The importance of inventory management are:

- Smooth customer's service.
- Efficient customer's service.
- To minimize the cost of corporation.
- Efficient use of capital.

In general every firm should keep the stock. But both excessive and inadequate inventory indicate over investment which create the problem of unnecessary tied up of the firms fund, excessive cost, the risk of liquidity and so on although it saves the cost on discount similarly inadequate inventories is also dangerous. Inadequate inventory doesn't meet the demand of customer's which has negatively impact to customers so proper balance of stock is required to smooth run organization. Any business should adopt the based idea and techniques of inventory management to solve problem of inventory in systematic and scientific way.

Good inventory management is important for the successful operation and their supply chains. Poor inventory management hampers operation, diminishes customers satisfaction and increases operation costs. There are some important of inventory management which is as below:

- I. Availability of all items of inventory.
- II. No excessive investment in inventory.
- III. Reasonable price: when we purchase the raw materials, there should be strict on the pricing of the raw materials. It should be reasonably low price and firm should be adjusted between price of raw material and its quality.
- IV. Minimum wastage: There should be minimum wastage of material while storing in the warehouse by the workers. Wastage should be allowed up to a certain level known as normal level of wastage and it should not exceed that level, storekeepers and worker should be trained to handle the material in a scientific way to avoid wastage.
- V. Risks of spoilage and obsolescence of inventory must be avoided for his purpose; a maximum quantity of catch item of inventory is

determined and proper method of issuing the inventory is followed LIFO and FIFO method is used to issue the inventory.

1.1.1 Background of the Nepal Oil Corporation Limited

Nepal Oil Corporation Ltd (NCO) is a state owned enterprise dealing in petroleum products its main business consists of importing, storing and distribution petroleum products to meet the energy requirement of nation. Realizing the need to institution of petroleum oil and lubricant product in the country. Nepal Government established Nepal Oil Corporation Ltd in 2027-09-26 B.S. (1974 A.D) under the company act 2021 (1964) as a state owned trading enterprise to fulfill the objectives as set in fourth five year national periodic plan. The government owned the majority of its share and four other state owned enterprises have also made investment in NOC. They are nationally Insurance Corporation, Nepal Bank Limited, Rastriya Banijya Bank and National Trading Limited.

NCO is the key supplier of fuel energy in the country it supplies petroleum product to meet a significant part of energy requirements, of the country. The objective of the corporation is to ensure smooth and uninterrupted distribution of petroleum product in the kingdom by negotiating with petroleum exporting countries buying from the soft market. The refined petroleum full bought from oil-exporting countries is transported to seaport of India border. Thus imported oil is given to Indian oil corporation (IOC) on the condition of receiving the same amount in the Nepalese border. And imported oil is distributed throughout the kingdom by agent or by corporation itself. The action plan has been effective since the agreement of NOC with IOC in 10th June 1990. Before this date, the corporation used to buy the petroleum products directly from international companies. In the agreement between Nepal and Indian Oil Corporation it has been decided to import the fuel

through different gates located in Indo-Nepal border on the basis of product exchange system.

After its establishment, NOC get monopoly in the import and distribution of petroleum products. Thus till this date NOC is and only one company dealing in major petroleum product in the country.

Different kinds of petroleum products have been imported for domestic use, air service, industries and transportation. Among them the cheap fuels like kerosene, Diesel, petrol and Aircraft fuel (ATF) come to the front. Besides light diesel Oil Corporation also supplies furnace oil and looking Gas Liquefied Petroleum Gas or (LPG).

1.2 Statement of the Problem

This study is primarily focused on inventory management of Nepal Oil Corporation Ltd (NOC). And how manage their inventory and what is the appropriate management policy? To handle inventory management problem we will take help of some tools and techniques regarding to inventory management. The specific problems that will be analyzed during the study which are as follows:

- What size of order should place by NOC?
- How is the inventory conversion position of NOC?
- How is the service position of NOC?
- How is the inventory position of NOC?

1.3 Objectives of the Study

Every study has certain objectives, in same way this study have also some objectives in course of inventory management of NOC. Even the prime objective of the study is inventory management of NOC, here is also determined some specific objectives which are as follows:

- 1) To know the optimum quantity of NOC for placing order to reduce cost.
- 2) To know inventory turnover ratio of NOC.
- 3) To know service position of NOC.
- 4) To know inventory level of NOC.

1.4 Limitation of the Study

The study has been conducted partial fulfillment of the master degree in business studies. So, there are some limitations regarding this study which are as follows:

- The study course only span of five years starting from the fiscal year.
- The study is limited to the area of inventory management of petroleum produce of NOC.
- The accuracy of the study is based on the data available from various published documents of NOC.
- Central office of NOC has provided the data based on monetary value so all the data are presented in quantity.

1.5 Importance of the Study

Inventory management is one of the most important functions in any organization without any effective and efficient inventory management; no organization can achieve its goals. Appropriate inventory management help to avoid unnecessary investment on the other hand neglecting the management of inventories will be jeopardizing corporations' proper activities and may fall ultimately. In this study, trying to know about inventory conversion period and optimal order size of NOC's petroleum products which helps to reduce ordering and carrying cost of NOC in

course of placing order and holding inventory at corporation and it also help to solve the unnecessary tied up fund of NOC. Beside this, there is also trying to know about service position of NOC's petroleum products which help to know how effecting consumers are getting service.

1.6 Organization of study

The research reports will be divided into five chapters, which are as follow:

Chapter 1: introduction, it will contain background of the study, focus of the study, statement of the problem, objectives of the study, limitation of the study, importance of the study and organization of the study.

Chapter 2: Review of literature which contains conceptual framework of the study, review of foreign and Nepalese researcher, reports, article and books.

Chapter 3: Research methodology contains research design, nature and sources of data, data collected procedure, data processing and analysis and limitations of methodology.

Chapter 4: Presentation and analysis includes theoretical analysis, data presentation and analysis and major finding of the study.

Chapter 5: Summary, conclusion and recommendations.

CHAPTER TWO

REVIEW OF LITERATURE

2.1 Inventory management

The term inventory refers to the stockpile of the product of a firm is offering for sale and the components that make up the product. In other words, "Inventory is composed of assets that will be sold in future in the normal course of business operation"¹. Inventory may be defined as the goods held for resale by the firm. As much inventories are vital elements in the efforts of the firm to achieve desired sales level.

"Inventory refers to the goods and materials used by a firm for the purpose of production and sales. It also includes the items, which are used as supportive materials to facilitate production. There are three basic types of inventory: raw materials, work-in-process and finished goods. Raw materials are the item purchased by firm for use in production of finished product. Work-in-process consisted of all items currently in the process of production. These are actually the partly manufactured products. And, finished goods consist of those items, which have already produced but not yet sold. Inventory constitutes one of the important items of current assets, which permits smooth operation of production and sale process of a firm"².

Inventory link between production and sale of product. The optimum level of inventories should be judged in relation to flexibility of inventories. The lower the level of inventories make less flexibility of the level of inventories make less flexibility of the firm. And higher level of inventory in cries flexibility of the organization.

¹ Khan, M.Y. & Jain, P.K., (2003:20.3), Financial Management New Delhi: Tata MC Graw Hill Co. Ltd.

² Rajan B. Poudel, Keshav J. Baral, Rishi R. Gautam & Suraya B. Rana, (2010:256), Managerial Finance. Bhotahity, Kathmandu: Asmita Books Publishers and distributors (P) Ltd.

Good inventory management is important for the successful operation and their supply chains. Poor inventory management hampers operation, diminishes customers satisfaction and increases operation costs³. "Inventory management is that aspect of a firm's working capital management, which is concerned with maintaining optimum investment in inventory and applying effective control system of inventory costs. Inventories as a type of current assets involve significant investment of funds. As the firm goes on investing more in inventories, the cost of funds being tied up will also be increasing. Therefore, inventory management is significant because it enables to resolve to basic but conflicting issues of a firms (1) maintaining adequate inventory for smooth production and selling activities and (2) minimizing investment in inventory to enhance firms profitability"⁴.

The term "Inventory management" is composed of two different words "Inventory and management". Inventory refers to any stock hold by a company for smooth running of production and marketing activities. On the other hand management is an art, which is devoted for planning, directing, coordinating and predetermined goal. Thus, inventory management can be defined as the planning, directing, coordinating and controlling of various activities which are concerned with inventory management.

2.2 Types of inventories

Manufacturing firms generally have four kinds of inventories which are given below:

³ William J. Stevenson, (2002:542), Operations management. MC Graw Hill Higher Education.

⁴ Rajan B. Poudel, Keshav J. Baral, Rishi R. Gautam & Suraya B. Rana, (2010:257), Managerial Finance. Bhotahity, Kathmandu: Asmita Books Publishers and distributors (P) Ltd.

A. Raw material Inventories

Raw material is those basic inputs that are converted into finished goods through the different manufacturing process. "Raw materials inventories are those units which have been purchased and stored for future production".⁵ Raw materials inventories are held by manufacturing firm for smooth running of production and operation. Material used factory traditionally classified as direct and indirect material. Direct material generally includes all material and parts that directly identified with the unit cost of the finished goods. Indirect material is generally defined as the material used in the manufacturing process, which cannot be identified. They are only the supporting material of the products."The level of raw material inventory is influenced by anticipated production, responsibility of production, reliability of source of supply and the efficiency of scheduling, purchasing and production operation"⁶.

B. Work-in-process inventories

Work-in-process inventory represent the semi-finished goods. "Goods in process include such items as components and sub assembles that are not yesterday to be sold"⁷.

Work-in-process is neither a finished product nor raw materials. It is the product in the middle of raw materials and finished product WIP inventories are strongly influenced by the length of production, which is the time between placing raw materials in production and completing the finished product. It is very difficult to separate which are WIP and which are not. The some materials may be a WIP as well as finished goods in order industry. It is depends upon nature of production.

⁵ Western, J. Fred & Copeland, Thomas E. (1992:814), Managerial Finance USA New York: A Hart curt Brace Javanich college publicer. The Dryden Press

⁶ Western, J. Fred & Copeland, Thomas E. (1992:321), Managerial Finance USA New York: A Hart curt Brace Javanich college publicer. The Dryden Press

⁷ Hampton & John J. (1990:235), financial decision making New Delhi: Prentice Hall of India Pvt. Ltd.

C. Finished goods inventories

"Finished goods inventories are those completely manufacturing products which are ready for sale. In a manufacturing firm, they are the final output of the production process stock finished goods are held by manufacturing and non manufacturing company for market operation"⁸.

D. Spare parts and suppliers inventories

Spare parts are those materials, which are used in maintenance and repairing function. And supplies are those materials, which are used in operating functions. Bolts, wheels oil, lubricant, grease etc. represent the spare and supplies.

2.3 Cost Associated with Inventories

The goal of the inventory management is to provide the inventories for sustaining operation at the lowest possible cost. The first step in inventory management is to identify all the costs involved purchasing and maintaining inventories typical costs associated with the inventories are described below.

A. Acquisition costs or ordering cost

Ordering cost consist of order cost, set up costs, set up costs or both ordering cost could include preparing and processing the order request selective a supplier, checking the stock, preparing the payment and receiving inventories levels. Set up costs to modifying the manufacturing process to make different goods. They include personal costs as well as capital equipment costs. Many firms use blanket orders to reduce order costs⁹.

⁸ Hampton & John J. (1990:228), financial decision making New Delhi: Prentice Hall of India Pvt. Ltd.

⁹ Bloomberg, David J., Leemay Stephen & Hann, Joe B. (2002:161), Logistics. New Delhi: Prentice Hall of India Pvt. Ltd.

The term ordering cost is used in case in raw materials (or supplies) and includes the entire cost of raw materials. They include cost incurred in the following activities.

- Requisitioning
- Order pacing
- Transportation
- Receiving, inspecting and storing
- Clerical and staff

Ordering cost increases with the number of orders, thus more frequency in inventory acquired, higher the firms ordering cost. One the other hands, if the firm maintains large inventories level, there will be a few orders placed and ordering cost will be relatively small. Thus ordering costs decreases with the inventory size of inventory. The fixed costs associated with ordering inventories as 'o' and we placed 'n' ordering per year, the total ordering cost is given as:

$$\begin{aligned}\text{Total ordering cost (TOC)} &= O \times N \\ &= O \times \frac{A}{Q}\end{aligned}$$

Where,

O = Fixed cost per order

N = No. of order

A= Annual requirement

Q = Inventory quantity for each order

B. Carrying cost or Holding costs

Total carrying generally increases in direct production to the average amount of inventory carried in turn depended upon the frequency with

which orders are placed. The cost associate with having inventories which includes storage cost, insurance cost depreciation cost and so on. These costs generally increase in production to the average amount of inventory held. Carrying cost varies with inventory size. This behavior is contrary to that ordering cost which decline with increase in inventory size. The carrying cost includes that cost incurred in the following activities.

- Capital or opportunity cost
- Insurance and taxes
- Warehousing cost
- Handling cost
- Clerical and staff cost
- Deterioration and obsolesce

Carrying cost is the first category management cost which is generally associated proportionally with the average value of inventory¹⁰. Total carrying cost is calculated as follows.

$$\text{Total Carrying Cost (TCC)} = (C) \times (P) \times (AI)$$

Where,

C = Percentage of carrying cost of inventory

P = Price per unit of inventory

AI = Average inventory in units

$$AI = A/Q + S$$

¹⁰ Solemen Ezra (1989:181), The Theiry of financial Management, New York

C. Stock out cost

"Stock out refers the shortage of stock to meet the demand of customers. Stock out cost includes the cost of back order, loss of goodwill, loss of profit, expenses incurred for receiving the stock from supplier and notifying the customers when goods have arrived"¹¹.

Stock out cost = Inventory cycles per year – output units × probability of possible stock out × unit stock out cost

2.4 Techniques of inventory management

To manage inventories effectively, a firm should use a systematic approach to inventory management. A systematic approach considers in a single model, all the factor that affect the inventory. The model called a systems, that may have any number of sub systems tied together to achieve a single goal. "In the case of inventories systems, the goal is to minimize the cost"¹².

"The financial manager should on the at optimum level of inventory on the basis of the tradeoff between cost and benefit, to maximize the owners wealth, wealth many sophisticated mathematical techniques are available to handle inventories problems. But they are move approximately a part of production management"¹³.

To manage inventories, the firm's objective should be in consonance with the less invest in inventory principle. To achieve this, the firm should determine the optimum level of inventory. Efficiently controlled inventories make the firm flexible. Inefficient control result unbalanced

¹¹ Laxman K. Regmi, Pushpa Raj Joshi, Arun K. Chaudhary, Ghanendra Fago and Hari Kumar Shrestha (2010:89), Production and Operations Management. Kathmandu Nepal: Buddha Academic Publishers & distributors (P) Ltd.

¹² Hampton & John J. (1990:235), financial decision making New Delhi: Prentice Hall of India Pvt. Ltd.

¹³ Khan, M.Y. & Jain, P.K., (2003:20.11), Financial Management New Delhi: Tata MC Graw Hill Co. Ltd.

inventory and inflexibility. The firm may sometimes runs out of stock and sometime may pile up unnecessary stock. This increases the level of investment and makes the firm's cost high.

To manage inventory efficiently, following two answer of the question should be given.

- How much should be ordered?
- When should it be ordered?

"The question, how much to order relates to the problem of determining economic order quantity and is answered with an analysis of costs of maintaining certain level of inventories. The second question, when to order, arises because of uncertainty and is a problem of determining the re-order point"¹⁴.

In every aspect of inventory management there is necessary control of inventory. There are various techniques of inventory control to avoid excess cost, physical loss, damage, theft, over inventory and lower inventory; some of these techniques are discussed below.

A. Economic Order Quantity (EOQ)

EOQ is important concept in the purchase of raw material and in the storage of finished goods and transit inventories, to determine the optimal order quantity for a particular item of inventory an given its forecasted ordering cost and carrying cost¹⁵.

EOQ refers to the order size that will result in the lowest total of ordering and carrying costs for an item of inventory. Of a firm places unnecessary order, it will incur unneeded order costs. If it places too few orders it must maintain large stocks of goods and will have excessive carrying

¹⁴ Pandey, I.M. (2002:902), financial management. New Delhi: Vikas Publishing House Pvt. Ltd.

¹⁵ Van Horne, James C. (2003:377), Financial Management and Policy. New Delhi: Prentice Hall of India Pvt. Led.

costs. By calculating EOQ, the firm identifies the number of units to order that results in the lowest total of these two costs"¹⁶.

How much to order or produce is one of the main problems of inventory management. That is the determination of a quantity for which the orders should be placed is one of the important problems concerned with inventory management.

The correct quantity to buy is the quantity, at which the cost of acquisition equals to the cost of possession. This technically known as the Economic Order Quantity or reorder quantity. EOQ refers to size/quantity under which minimize the total or set up cost and holding or carrying cost constitute the total cost of inventory excluding material cost. Increase in ordering number increases the ordering cost, but decrease the holding cost and vice-versa. EOQ is determined at a level for which the ordering cost and carrying cost is equal and minimum in total. Therefore it is necessary to calculate Economic Order Quantity which minimizes carrying cost and ordering cost in course of inventory management. Reorder quantity is such that when it is added to the minimum stock, it should not exceed the maximum stock.

a. Assumptions of Economic Order Quantity (EOQ)

- There is a continuous, constant and known demand rate.
- The lead time/replenishment cycle is known and constant.
- The constant purchase price is independent of the amount ordered.
- Transportation costs are constant no matter the amount moved or the distance travel.

¹⁶ Hampton & John J. (1990:231), Financial decision making. New Delhi: Prentice Hall of India Pvt. Ltd.

- No stock outs are permitted.
- There is no inventory in transit.
- All inventory parts are independent in each other.
- The planning horizon is infinite.
- There is no limit on the amount of capital available.
- Prerequisite for EOQ.

Following facts are to be considered as prerequisites for determination of EOQ.

- I. Holding cost per unit per period/year.
- II. Ordering cost per order.
- III. Annual requirement or quantity required per period.
- IV. Cost per unit.

Approached to set EOQ

EOQ model can be determined by following methods.

- I. Mathematical or formula method
- II. Trial and error approach
- III. Graphic method

I. Mathematical or formula method

Mathematical models are also available to calculate economic order quantity. There are numerous modern exist as the field of inventory management and can be studied in college programs such operation research and production management. Even many mathematical model exists, the main objective of these model is to reduce, minimizes the inventory costs or total costs.

We can illustrate the concept of EOQ, without highly refined decision models, with a basic mathematical model. We calculate EOQ by using the following formula.

$$EOQ = \sqrt{\frac{2AO}{C}}$$

Where,

A = Annual demand/requirement/Sales

O = Ordering cost per order

C = Carrying or holding cost per unit per year

EOQ = Economic Order Quantity

II. Trial and error approach

This is another approach to calculate economic order quantity. A firm has different alternative purchases policy of inventory. It can purchase its entire requirement on one single lot and alternatively, the firm can purchase its inventory in small lots periodically say weekly, monthly, bimonthly, half yearly and so on. It means more than one item the firm can place an order to purchase inventory. The smaller the lot sizes the lower average inventory and vice-versa. Low inventory holding are associate with high ordering cost and low carrying cost. This approach for the determination of EOQ uses different permutations and combination of total costs (Ordering + Carrying) of inventory is the economic order quantity¹⁷.

A tabular arrangement of data relating to items of material may allow the determination of appropriate EOQ. In this approach following points are included.

¹⁷ Khan, M.Y. & Jain, P.K., (2003:20.7), Financial Management New Delhi: Tata MC Graw Hill Co. Ltd.

- No. of orders = Increase no. of order decreases order size
- Order size = Annual requirement divided by no of orders
- Average inventory = Half of order size
- Ordering cost = Ordering cost per order \times No. of order
- Carrying cost = Average inventory \times Carrying cost per unit per year
- Total cost = Ordering cost + Carrying cost

III. The Graphic Approach

It should be noticed that the total cost of inventory are fairly incentive to moderate changes in order size. It may be appropriate to say that there is an economic order range, not a point. To determine this range, the order size may be change by some percentage and impact on total costs may be studied. If the total costs do not change very significantly the firm can change EOQ within the range without any loss¹⁸.

The economic ordering quantity can also find out graphically as below.

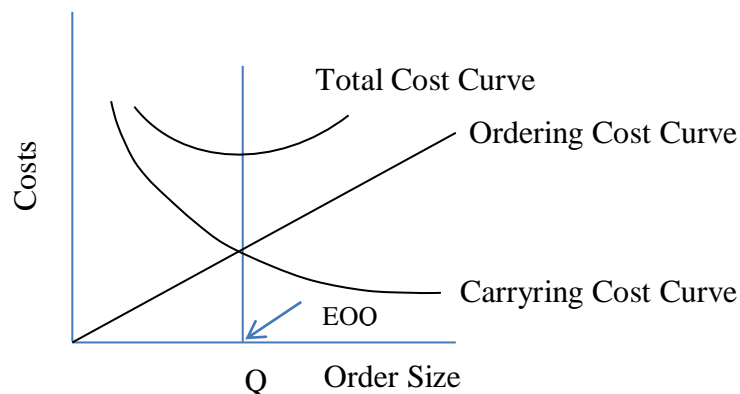


Figure No. 2.1: Graphic Approach of EOQ

¹⁸ Pandey, I.M. (2002:888), Financial management. New Delhi: Vikas Publishing House Pvt. Ltd.

Figure 2.1 illustrates the EOQ function on above, in the figure carrying, ordering and total costs are plotted on vertical and horizontal axis is used to replacement the order size. Total carrying increases as the order size increases, because on an average, a larger inventory will be maintained and ordering cost decline with increase in order size because large order size means less numbers of orders. The behavior of total cost is noticeable since it is a sum of two types of costs, which behave different with order size. The total decline in the first stage, but it starts to rise when the decrease in average ordering cost is more than offset by the increases in carrying cost. The EOQ occur at the point 'Q' where the total cost is minimum.

B. Stock level sub-system

Carrying of too much and too little of inventories is deterring mental to the firms. If the inventory is too little, the firm will face frequent stock outs involving high reordering cost and if the inventory level is too high, it will be necessities of capital. Therefore an efficient inventory management requires that a firm should maintain the optimum level of inventory where inventory cost are minimum and at the same time there is no stock out which may, result in loss of sale or stoppage of production various stock levels are¹⁹.

a. Minimum Level

It represents the minimum quantity of inventories, which must be maintained in hand at any time. In this level following factors are taken into consideration.

- i. Lead time i.e. time lag between denting and receiving of the inventory.
- ii. Rate of consumption of the inventories during the lead time.

¹⁹ Nair, N.K & Agrawal, G.R (1998:220) , Purchasing and Material management, New Delhi : Bikas Publishig House Pvt. Ltd.

iii. Nature of inventory, minimum level is not require in case if special inventory.

Formula of minimum level = Reordering level – (Normal consumption × Normal reorder period)

b. Maximum level

Maximum level represents the maximum quantity of item of inventory that can be hold in stock, any time that stock should not exceed this quantity. The quantity is fixed so that may be no over stocking. The maximum stock level is fixed by taking into account the following factors.

- I. Amount of capital available for maintain stores.
- II. Golden space available.
- III. Maximum requirement of the stores for production purpose at any paint of time.
- IV. Rate of consumption of the materials during the lead time.
- V. The time lag between ideating and receiving of the inventory.
- VI. Fluctuation in price.
- VII. The seasonal nature of supply of inventory, some item of inventory goods are available only during specific periods of the year, so these have to be stocked heavily during these periods.
- VIII. Possibility of change in fashion and habit, which will necessitate change in requirement of materials.

Formula of maximum stock level = Reorder level + Reordering quantity – (Minimum consumption × minimum reordering period)

C. Re-ordering level

The re-order point is the level inventory at which firm places an order in the amount of the economic order quantity. If the firm places the order when the inventory reaches the re-order point, the new goods will arrive before the firm runs out of goods to sell. To determine the re-order point under certainty, there are three information needed.

Re-order point = (Daily Consumption × Lead time) + Safety Stock

I. Usage rate

This is the rate per day at which the item is consumed in production. It is expressed in units.

II. Lead time

It refers to the time normally between placing an order and receiving the delivering of inventory. Lead time covers the time span from the point when a decision to place an order for the procurement of inventory is made to the actual receipt of the inventory by the firm. It is also called procurement time of inventory. It is expressed in days, weeks, and months.

III. Safety stock level

The minimum level of inventory may be expressed in days this level can be computed by multiplying the usage rate times and the numbers of days that the firms want to hold as a protection against shortage.

Safety Stock = $\sqrt{\text{Average consumption during the lead time}}$

d. Danger level

This is a level at which normally issued orders of the material are stopped and issued are made only specific instructions. The firms will make special

arrangement to get the material, which reach at their danger levels so that the production may not stop due to shortage of materials.

Danger level = Average consumption \times Minimum lead time

2.5 Objectives of inventory management.

Inventory is the most important to all organization in today's industrial world. So, it is necessary to manage it properly because both situations of inventory i.e. either excessive or in adequate are not desirable to the industry. The excessive level of inventories tied up the firms fund and cannot be used for another purpose. In the other hand maintaining an in adequate level of inventory minas under investment in raw materials inventory and work-in-process inventory, which five result frequent production interruption and similarly finish goods inventories are not sufficient to meet the demand of consumer regularly. There various objectives of inventory management can be summarized up as follows²⁰.

- VI. Availability of all items of inventory.
- VII. No excessive investment in inventory.
- VIII. Reasonable price: when we purchase the raw materials, there should be strict on the pricing of the raw materials. It should be reasonably low price and firm should be adjusted between price of raw material and its quality.
- IX. Minimum wastage: There should be minimum wastage of material while storing in the warehouse by the workers. Wastage should be allowed up to a certain level known as normal level of wastage and it should not exceed that level, storekeepers and worker should be trained to handle the material in a scientific way to avoid wastage.
- X. Risks of spoilage and obsolescence of inventory must be avoided for his purpose; a maximum quantity of catch item of inventory is

²⁰ Goyal, E. (1997:69), The Theory of Financial Management, New York

determined and proper method of issuing the inventory is followed LIFO and FIFO method is used to issue the inventory.

- XI. Inventory about availability of stock should be made continuously available to the management. So the planning of production may be done. The storekeeper can supply this information because he keeps and up-to-date record of every item of stocks under proper systems of inventory control.

2.6 Material management

Material management is the process of managing materials, parts, components and equipments for operation of organization. It is responsible to make plan, organization and control activities relating to materials, parts or components of product. In other words, it can be defined as the grouping of management functions supporting the complete cycle of material flow from purchase and internal control of production material of work in process to the warehousing, shipping and distribution of the finished goods which helps to cost reduction, smooth operation and maintaining quality in course of inventory management.

It is a process of managing activities relating to flow of materials into and through an organization. For our purpose, material management concerns with managing purchasing functions, which is related to acquisition of material and parts from suppliers producers and others²¹.

2.7 Review of related studies

Above we have emphasized on the review of text books only but attempt is also made to review the related studies conducted by different agencies, experts related with inventory management of organization in Nepal.

²¹ Laxman K. Regmi, Pushpa Raj Joshi, Arun K. Chaudhary, Ghanendra Fago and Hari Kumar Shrestha (2010:119), Production and Operations Management. Kathmandu Nepal: Buddha Academic Publishers & distributors (P) Ltd.

Some studies have been made in the subject of inventory management but few studies are review in this chapter.

- I. Mr. Amrit Kumar Sharma Gaire has conducted a research work on the topic of Inventory Management: A Case Study of Royal Drugs Ltd., the main objective of this study is to identify the problem underlying in inventory management and control system of RDL other objectives of his study are:
 - To assess the types of inventory maintained in RDL.
 - To examine the techniques being employed to manage the inventory in RDL.
 - To suggest proper inventory model to RDL bases on analysis.
 - To find out inventory position of RDL.

On the basis of study conducted by Mr. Gaire the following suggestion have been recommended.

- a) The Co. should define its objective and goals clearly.
 - b) The Co. should follow all the quantitative technique and models such as EOQ model, ABC analysis model which help to reduce total inventory cost.
 - c) Bin cards can also use to manage inventory in a simple way.
 - d) General Manager should be professional and he should not political interference²².
- II. Puskar Bajracharya has conducted his study on management. In public sector manufacturing enterprises in Nepal. The main objectives of his study are to find out the different problems faced by public sector manufacturing organization in Nepal. One of the important findings was the inventory management suffers from the

²² Gaire, Amrit Kumar Sharma (1999), Inventory Management: A Case Study of Royal Drug Ltd., Unpublished Master's Degree Thesis of Faculty of Management, TU

lack of planning, high carrying costs, poor record keeping and stores management and virtual absences' of controlling system²³.

- III. Bishnu Pradhan has conducted a study on significance of inventory management of Nepalese manufacturing enterprises. He has studied the reaction of inventories to total assets of enterprises. One of the important findings, average invest was about 22 percent of total assets in the form of inventory in 200/01 by Nepalese enterprises. It indicates that large amount of money has to invest in the form of inventory. Hence the inventory management has great significance²⁴.
- IV. Krishna Narayan has conducted the study on the topic of Inventory Management of Royal Drug Ltd. His study stated that to achieve the objective of Royal Drug Ltd., the efficient management of inventory is essentials. If the Royal Drug Ltd. applies the scientific techniques of inventory management, certainly it will cope its objectives very successful. He further suggested that, purchase plan should be prepared for different types of raw materials with proper companies coordination and cooperation among the different department like planning, purchasing, storing, producing marketing, selling etc. to avoid the excessive investment on inventory. He also recommended that for purchasing various types of raw materials and inventory, the company should use significant inventory management techniques to minimize total inventory cost i.e. carrying and ordering cost²⁵.

²³ Bajrachaya, Puskar (1983), "Management in Public Sector Manufacturing in Nepal", Unpublished Master's Degree Thesis of Faculty of Management, TU

²⁴ Pradhan, Bishnu (2000), Significance of Inventory Management of Nepalese Manufacturing Enterprises, Unpublished Master's Degree Thesis of Faculty of Management, TU

²⁵ Shrestha, Krishna Narayan (2000), Inventory Management of Royal Drug Ltd., Unpublished Master's Degree Thesis of Faculty of Management, TU

- V. Mr. Vijaya Sharma on his study of Inventory Management of AIC regarding seeds indicated that the inventory turnover ratio is an indication of the efficiency of management. The very low inventory turnover ratio of wheat shied shows an inefficient inventory management system²⁶.
- VI. Dr. Govinda Ram Agrawal has made a study relating to the Nepalese Public Enterprises, which stated that inventory management is the weakest aspect of the management. The tools and techniques for controlling inventory have not been applied in Nepalese manufacturing enterprises for controlling their physical as well as their financial dimension²⁷.
- VII. Puspa raj Baral has also made study regarding Inventory Management: A Case Study of Gandaki Noodles Pvt. Ltd. The main objectives of his study are to highlight the company's policies, objectives, function and activities regarding inventory management. Finally he came to know that factory is following neither economic order quantity model in its purchasing decision nor ABC analysis ion inventory management²⁸.
- VIII. Radha Kumari Balika has conducted his study on Inventory Mangement: A Case Study of Hetauda Cement Factory. She had founded that Hetauda Cement Factory Limited was in problem of overstocking of raw material and work-in-process. This might be the outcome of inefficient management system of inventories. Due

²⁶ Sharma, Vijaya (1999), Inventory Management of AIC Regarding Seeds, Unpublished Master's Degree Thesis of Faculty of Management, TU

²⁷ Agrawal, Dr. Govinda Ram (1980), Management in Nepal, Kathmandu, CDC. TU

²⁸ Baral, Pushpa Raj (1994), Inventory Management: A Case Study of Gandaki Noodls Pvt. Ltd. Unpublished Master's Degree Thesis of Faculty of Management, TU

to this fact she concluded that the production and sales plane of the factory is not practicable and realistic²⁹.

- IX. A Study relating to Transport Corporation concerning with various aspects has been made by CEDA. The major objective of the study to find out present inventory management practice in Transport Corporation. One of the major findings is that through inventory management of this corporation is poor management of stocking of spare parts which has hampered the smooth operation of the enterprises³⁰.
- X. Saroj Sigdel conducted the research work regarding Inventory Management of Agriculture Input Corporation (AIC). He stated that SIC is not using scientific model ion inventory management. Although they did calculate EOQ for the supply of chemical fertilizer, their order lots is 1000 to 2000 m. ton. Lead time and reorder point is not calculated and ABC analysis also is not used³¹.
- XI. A Case Study has been conducted by Mr. Surendra Shrestha regarding Inventory Management of Gorkahpatra Corporation. His main objective is to find out the inventory position of the organization and to provide different suggestion. Regarding inventory management. He had concluded that Gorkhapatra had not applied any tools and techniques of inventory management. In that corporation that was difficult but not impossible to apply that inventory management techniques because of lack of certain data³².

²⁹ Balika, R.K. (1996), "Inventory Management: A Case Study of Hetauda Cement Factory Limited", An Unpublished Thesis. TU

³⁰ CEDA, (1973), A Study of Transport Corporation of Nepal, Kirtipur, TU

³¹ Sigdel, S. (2002), "Inventory Management: A Case Study of Agriculture Input Corporation", An Unpublished Thesis, TU

³² Shrestha, S. (1988), "Inventory Management: A Case Study of Gorkhapatra", An Unpublished Thesis, TU Kirtipur

CHAPTER THREE

RESEARCH METHODOLOGY

This chapter shows the way to solve the problem systematically or achieve the objectives presented in the earlier chapter. To achieve those objectives or solve the problem we need some information which is based on secondary data. Those information or data will be collected through annual report of NOC and published and unpublished books, articles, magazine, official's records and documents relating to NOC. The available data will be analyzed by different tools and techniques; they are economic order quantity model, inventory turnover ratio, re-order point and other statistical tools.

3.1 Research Design

In this study, at first we will review that previous study relating to inventory management topic from where we will get some knowledge about it. To achieve those listed objectives or solve the problem we need some information about NOC. The required information or data, we will collect through published and unpublished books, articles, annual report, magazine, official records and documents relating to NOC. Besides this, the researcher will frequently visit on central office of NOC and website of NOC to collect required data for achieving objectives of study. The researcher will analyze those collected data by applying different tools and techniques relating to inventory management such as economic order quantity, re-order point, inventory turnover ratio and statistical tools.

3.2 Nature and Sources of Data

Information is the lifeblood of any research work. In this study secondary data is more important to achieve the objectives of study, here is used

only secondary data because of various difficulties and secondary data is also enough for achieving objectives. While secondary data were collected from the following sources:

- Studying and analyzing the annual reports of NOC.
- Books, articles, magazine and official records of NOC.
- Published and unpublished documents related to NOC.

3.3 Data Gathering Procedures

The secondary data are directly obtained from various sources mentioned above for the purpose of data an analysis are taken from official records, published and unpublished and unpublished documents, books, articles, magazines. The researcher has to make frequent visits to NOC office in order to collect the required data from officials.

3.4 Period of Study

The study covers the period of five year i.e. FY2063/064 to 2067/068

3.5 Methods of Analysis

Inventory management involves determining how many inventories to hold? When to place order? How many units to order at a time? In order to achieve the organizations goal there is a need of effective inventory management system. In this study, data collected from various sources were managed, analyzed and presented in proper way including tables, figures and graphs with proper interpretation and explanation. The inventory management techniques applied in this study are Economics Order Quantity (EOQ), Re- order level similarly Inventory turnover ratio the part of financial analysis. There is an also used statistical tool, trend analysis.

3.5.1 Descriptive Analysis

Descriptive analysis consists of the quality control procedure, store capacity and distribution system of NOC.

3.5.2 Inventory Management Tools

Inventory management tools are used to analyze the inventory management aspects of NOC. The inventory management tools applied in the study is as follows.

3.5.2.1 Economic Order Quantity (EOQ)

An EOQ technique is the most important of inventory management. It attempts to establish the most economic balance between the carrying costs and ordering costs determining the quantities to be ordered. The economic order quantity is that inventory level, which minimizes the total of ordering and carrying costs. The relationship between the ordering costs and carrying costs are called cost factor. EOQ is calculated in Rupees due to the unavailability of data in quantity.

EOQ can be determined by following way.

i. Formula Method:

$$EOQ = \sqrt{\frac{2AO}{C}}$$

Where,

EOQ = Economic Order Quantity

A = Annual requirement

O = Ordering cost

C = Carrying cost

Thus, EOQ mainly depend on two types of costs.

a) Ordering Cost

Ordering costs are also termed as preparation costs. These are those types costs, which are incurred in connection with ordering and procurement. They are primarily fixed cost relating to the starting of production or the writing of an order for purchase and don't vary with the number of items in the lot.

b) Carrying Cost

Inventory carrying costs are also known as stock holding costs or what is called as inventory holding costs. These costs vary directly with the number of items involved.

ii. Table Method

$$\text{Order size} = \frac{\text{Annual requirement}}{\text{Number of order}}$$

$$\text{Average inventory} = \frac{\text{Order Size}}{2}$$

$$\text{Total Carrying cost} = \text{Carrying cost per unit} \times \text{Average inventory}$$

$$\text{Total Ordering cost} = \text{Total cost of an order} \times \text{Number of order}$$

3.5.2.2 Inventory Turnover (ITO)

Inventory turnover is calculated to show the rate of turnover of stock. This will show how many times the stock has turned over, when the figure of number of times is going on increasing, indicating a trend that the stock is fast moving from reference point of view. This ratio should be 7 to 18 times. This ratio is worked out by dividing the COGS with the average inventory. We can write this as

$$\text{Inventory Turnover} = \frac{\text{COGS}}{\text{Average Inventory}}$$

This measures the efficiency on inventory management and how quickly inventory can be sold. It indicates the relationship between the cost of goods and the inventory level. As we know that higher 'ITR' is better than low ratio. High turnover ratio indicates that a firm has good inventory management system and it is able to earn profit selling quickly over a period of time. Likewise, low turnover ratio indicates that a firm has poor inventory management system and firm has more stock of finished goods for sales.

3.5.2.3 Re-ordering level

The re-order point is the level inventory at which firm places an order in the amount of the economic order quantity. If the firm places the order when the inventory reaches the re-order point, the new goods will arrive before the firm runs out of goods to sell. To determine the re-order point under certainty, there are three information needed.

I. Usage rate

This is the rate per day at which the item is consumed in production. It is expressed in units.

II. Lead time

It refers the time normally between placing an order and receiving the delivering of inventory. Lead time covers the time span from the point when a decision to place an order for the procurement of inventory is made to the actual receipt of the inventory by the firm. It is also called procurement time of inventory. It is expressed in days, weeks, and months.

III. Safety stock level

The minimum level of inventory may be expressed in days this level can be computed by multiplying the usage rate times and the numbers of days that the firms want to hold as a protection against shortage.

3.5.3 Statistical Tools

Some important statistical tools are used to achieve the objective of this study. In this study, statistical tools trend analysis is used. Trend analysis shows the inventory level of different throughout different time period.

CHAPTER FOUR

ANALYSIS AND INTERPRETATION

4.1 Introduction

The chapters deals on processing the obtained data analysis and interpret them. The available data are presented in table and graph and they are analyzed with help of statistical, mathematical and inventory management tools and finally interpreted to explore the facts. This study explains of petroleum products they are petrol, Diesel, Kerosene and Aviation Fuel.

4.2 Procurement Procedure of NOC

During Indo-Nepal impasses in 1980/90, Nepal Oil Corporation (NOC) had very hard time. It had to meet the national requirement of various petroleum products as Indian had discounted the supply to Nepal. NOC imported small cargo of kerosene, petrol, aviation fuel and diesel mostly in term contracts from third county supplies and store them in some store tanks at Budge & Badge near Calcutta. The products taken to Nepal by tank dory shipments under NOC's own arrangements and risk.

Later on when the trade and transit issue between Nepal and India was normalized. NOC and IOC (Indian Oil Corporation) reached an agreement a 30th June 1990 for the supply of various petroleum products to Nepal. This agreement is reviews in every five years.

On the basis of agreement Nepal Oil Corporation imported kerosene and diesel cargoes of 30000 MT as per IOC's demand and fulfilled the national requirements of different petroleum products from the various IOC depots across Indo-Nepal boarder. Incorporating the changes of some matters, following to the development of Indian and Nepalese

government's policies and NOC reviewed this agreement on 27th June 1995.

The agreement signed in 1995 allowed NOC to discharge the cargo at parade as a first discharge part to vessel. Earlier to 1996 both kerosene and Diesel cargoes used to get discharged at Madras and Holdia. Initially in 1996 only the diesel cargoes used to go to parade and kerosene cargoes had to go Madras for the partial discharge.

Petrol and aviation fuel comes under kerosene cargoes and price is determined the basis of average weight with refinery differential of imported kerosene. Furnace oil and light diesel come under diesel cargoes and price is determined on the bases of average price of furnace oil in Singapore and Arabian gulf on the other than, India also purchase furnace oil from APM (Administered Price Mechanism). IOC adds profit margin in that price while determining the rate of furnace oil imports. So furnace oil becomes slightly expensive then rate of APM.

4.3 Process in procuring cargo

NOC procures diesel and kerosene cargo under the direction of Governing Board of NOC. IOC suggests buying cargo for every three months to NOC and NOC announce tender as per suggestion. While announcing tender, NOC announces Global tender and asks offer from importer to mailing asks offer from importer to mailing list in telex. Now there are 26 companies in mailing list. A definite period is provided to accept telex offers and offer received earlier or later then the given period are not valid. Such period is of 24 hours and the telex room is sealed for that period. In the eve of that period reprehensive of ministry of supply and concern respective of NOC sign in two telex roll and next signature is taken at the bottom of the telex roll after opening the seal. The original copy of telex roll is kept safety. The Governor Board decides about

procuring in the date offer received and the committee must decide immediately as the validity is very short in the offer.

Payment for cargo to IOC is done as follows.

A. 50% amount after 5 days of cargo received.

B. Rest after 50 days of B/L (Bill of Landing) date.

Note: Payment is done on Indian currency at exchange rates of State Bank of India on the date of cargo unloads.

4.4 Inventory Turnover Ratio (ITR)

Finished goods inventory is the cushion between sales and purchase for non manufacturing enterprise. Level of inventory depends upon sales and purchase of goods of the when sales exceeds purchase the inventory is used for sales and level of inventory going to be decrease and on the other hand when purchase exceeds the sales then the exceeds purchase is kept in the store and the level of inventory is going to be increased. A certain level of inventory is needed for smooth sales activities of enterprises.

Inventory turnover ratio is also called stock velocity turnover ratio. The inventory turnover ratio measures how quickly inventory is sold. It is a test of efficient inventory management. The inventory turnover ratio is calculated by using the following formulas.

$$\text{i) Inventory Turnover Ratio} = \frac{\text{Cost of good sold}}{\text{Average Inventory}}$$

$$\text{ii) Inventory Turnover Ratio} = \frac{\text{Sales}}{\text{Closing Inventory}}$$

The above table shows the inventory turnover ratios of different items from FY 2063/064 to 2067/068. From the table it is observed that inventory turnover ratios are 23, 64, 39 and 14 times of petrol, Diesel, Kerosene and Aviation Fuel respectively in FY 2063/064. In FY 2064/065 inventory turnover ratio of petrol is 19 times, 57 times of Diesel, 75 times of kerosene and 16 times of Fuel are 13, 21, 7 and 7 times respectively. In FY 2066/067 inventory turnover ratios are 16, 33, 8 and 8 times of petrol, Diesel, kerosene and Aviation Fuel respectively and in final year 2067/068 inventory turnover ratio are 18, 55, 80 and 12 times of petrol, Diesel, kerosene and Aviation Fuel respectively.

In all over the study period the inventory turnover ratio of Kerosene and Aviation Fuel is 7 times in FY 2065/066 is the lowest of all of them. Analyzing this inventory turnover ratio it is found that ITR of all products in FY 2065/066 is very lower than previous years and succeeding years. This happened because of NOC can't purchase sufficient petroleum products being various cause and on the other hand corporation gave not enough storage facility.

The accumulated turnover ratio of these for products can be presenting in following table.

Table no. 4.2

Total inventory turnover of petroleum products

(In kilo liters)

Year	Sales	Closing inventory	ITR
2063/64	670,227	19,062	35.16
2064/65	627,701	16,899	37.14
2065/66	739,661	51,592	14.14
2066/67	913,194	44,927	20.33
6067/68	993,578	35,584	27.92
	Average		26.94

Source: NOC Ltd. Central Office, Kathmandu

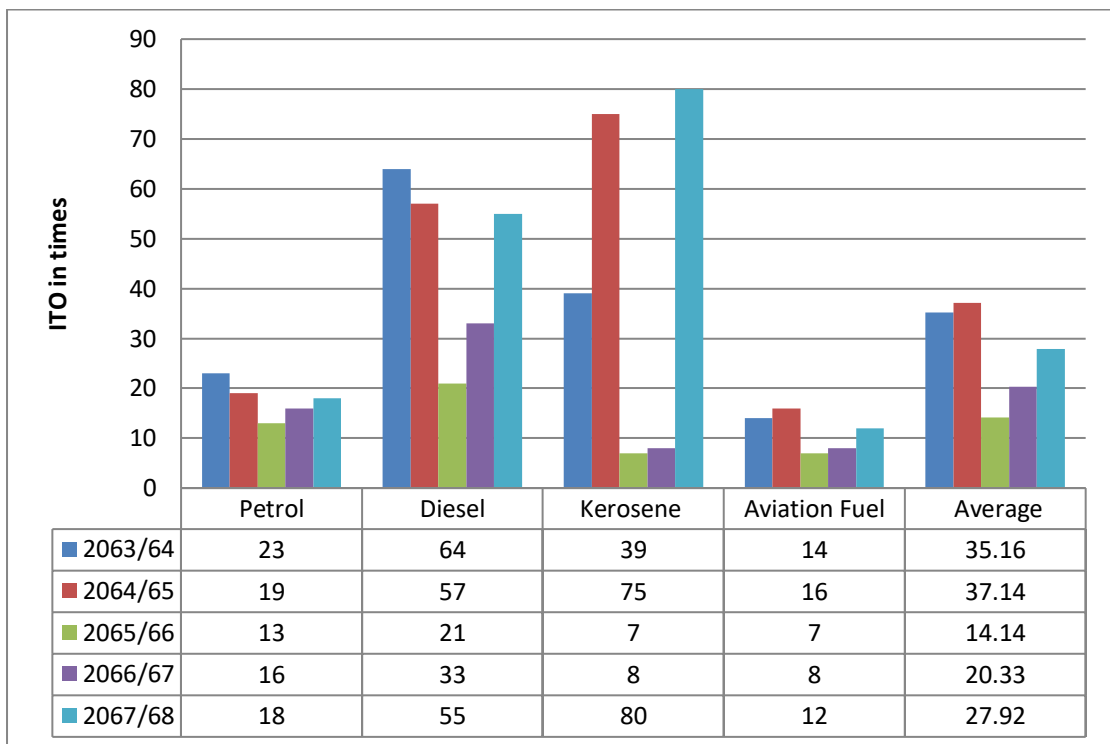
From the above table it is clear that the maximum inventory turnover ratio is 37.14 times in FY 2064/065 and minimum inventory turnover ratio is 14.14 times in FY 20656/066. Average inventory turnover ratio is 26.94 times. It means that NOC holds 13.36 days ($360/13.36$) in average of petroleum products. Higher inventory turnover ratio is the cause of increased in sales and decreased in closing stock or can't purchase enough petroleum products. In general lower inventory turnover ratio is better than higher inventory turnover ratio. It is indicator of little investment on inventory and low holding cost of inventory and low holding cost of inventory. On the other hand low inventory turnover ratio some time does not meet customer demand which is drawback of its.

The main reason to have lower inventory turnover ratio of NOC due to high demand of products, can't purchase enough because of various barriers and not reasonable policy of corporation. Excessive inventory involves cost items of interest on funds locked up, rental of space, possible determination and so on.

However inventory turnover ratios varies according to types of corporation and can find its satisfactory level of ITR on the basis of company ratio over a period of time through the trend analysis or comparing level of other firms in same type of business.

Figure No. 4.1

Inventory turnover ratio of Petroleum products



The above figure shows the inventory turnover ratio of petrol and diesel are decreasing in beginning and increasing in ending. And in case of kerosene and aviation fuel the inventory turnover ratio are increasing in first year, then decreasing from second year. And ultimately it is in increasing rate from fiscal year 2065/66. In case of total inventory turnover ratio. It is in decreasing rate in beginning and it start to increase from fiscal year 2065/66. In average the inventory turnover ratio is good but problem is that variation is very high.

4.5 Variance Analysis between Estimated Closing Stock and Actual Closing Stock

NOC can estimate its closing stock of the goods. There may be variance between actual closing stock and estimated closing stock. The estimated closing stock can be determined by following ways.

Opening stock + Purchase – Sales = Estimated closing stock

The following table shows the variance between estimated and actual closing stock from FY 2063/064 to 2067/68 in total.

Table No. : 4.3

Annual estimated closing stock and actual closing stock

(In kilo liters)

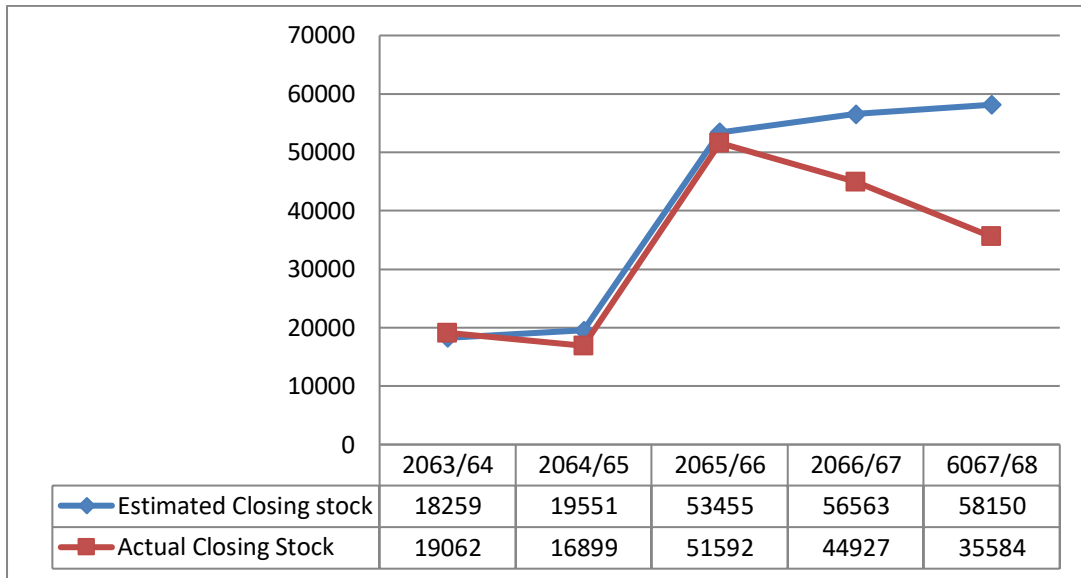
Fiscal Year	Estimated Closing stock	Actual Closing Stock	Variance	Percentage
2063/64	18,259	19,062	803	4.4
2064/65	19,551	16,899	2,652	13.56
2065/66	53,455	51,592	1,863	3.49
2066/67	56,563	44,927	11,636	20.57
2067/68	58,150	35,584	22,566	38.81

Source: NOC Ltd. Central Office, Kathmandu

Analyzing the above table it is found that there are large variance between estimated closing stock and actual closing stock in FY 2067/068, 2066/067 and 2065/065. In FY 2067/068 there is highest variance of 22,566 KL with proportion of 38.81% and in FY 2063/064 there is lowest variance in 1863 KL with proportion of 3.49%. These various also can be shown clearly in graphical presentation.

Figure no. 4.2

Estimated closing stock and actual closing stock



The above graph shows the variance between estimated closing stock and actual closing stock. The gap between these two stocks is close in beginning but coming in latter it is very high. In FY 2064/064 actual closing stock is more than estimated closing stock after then estimated closing stock is mover until in FY 2065/066 there is not so more variance but after then it is very high. This variance occurs due to normal and abnormal losses. Normal losses include shrinkage, normal abnormal losses occur due to mishandling, carelessness, accident and improper management etc.

4.6 Economic Order Quantity (EOQ)

Economic Order Quantity (EOQ) is the order size that will result in the lowest total of ordering and carrying cost for an item of inventory. The optimal level of different petroleum product has been determined by the application of EOQ model. Even this studies is concern for 5 economic years from 2063/64 to 2067/68, there is calculated EOQ for only one

economic year that is fiscal year 2067/68 because of not available of datas.

A. Petrol

The optimal level of petrol has been determined by applying the different approach of EOQ model which are as follows:

I. Mathematical or formula method

Mathematical or formula method is also one importance tools of EOQ model under this model we have calculated as follows:

Annual requirement (A) = 188,082 KL

Carrying cost per KL (C) = Rs. 4,710

Ordering cost per order (O) = Rs. 16,200,000

Note: Source: NOC Ltd. Central Office, Kathmandu

By applying EOQ formula:

$$\begin{aligned}\therefore \text{EOQ} &= \sqrt{\frac{2AO}{C}} \\ &= \sqrt{\frac{2 \times 188,082 \times 16,200,000}{4,710}} \\ &= 35,969.60 \text{ KL} \\ \therefore \text{EOQ} &= 35,969.60 \text{ KL}\end{aligned}$$

$$\begin{aligned}\text{No. of order} &= \frac{\text{Annual requirement}}{\text{EOQ}} \\ &= \frac{188,082}{35,969.60} \\ &= 5.23 \approx 5 \text{ times}\end{aligned}$$

From above calculation we can conclude that, the EOQ is 35,969.60 KL and no. of orders are 5 times, where NCO can reduce his total cost (total ordering cost + total carrying cost).

II. Trial and error approach or table method

Trial and error approach or table method is another importance model of economic order quantity model under this model we have calculated as follows:

Table No. 4.4

Trial and error approach or Table Method of EOQ

No. of order	Order size in KL	Average inventory in KL	Total carrying cost (Rs.)	Total Ordering cost (Rs.)	Total cost (Rs.)
1	188,082	94,041	442,933,110	16,200,000	459,133,110
3	62,694	31,347	147,644,370	48,600,000	196,244,370
5	37,616	18,808	88,585,680	81,000,000	169,585,680
7	26,869	13,435	63,278,850	113,400,000	176,678,850
10	18,808	9,404	44,292,840	162,000,000	206,292,840

Source: NOC Ltd. Central Office, Kathmandu

Note:

$$\text{Average inventory} = \frac{\text{Order Size}}{2}$$

$$\text{Carrying Cost} = \text{Average inventory} \times \text{Carrying cost per KL}$$

$$\text{Ordering Cost} = \text{No. of order} \times \text{Ordering cost per order}$$

$$\text{Total Cost} = \text{Total Ordering Cost} + \text{Total Carrying Cost}$$

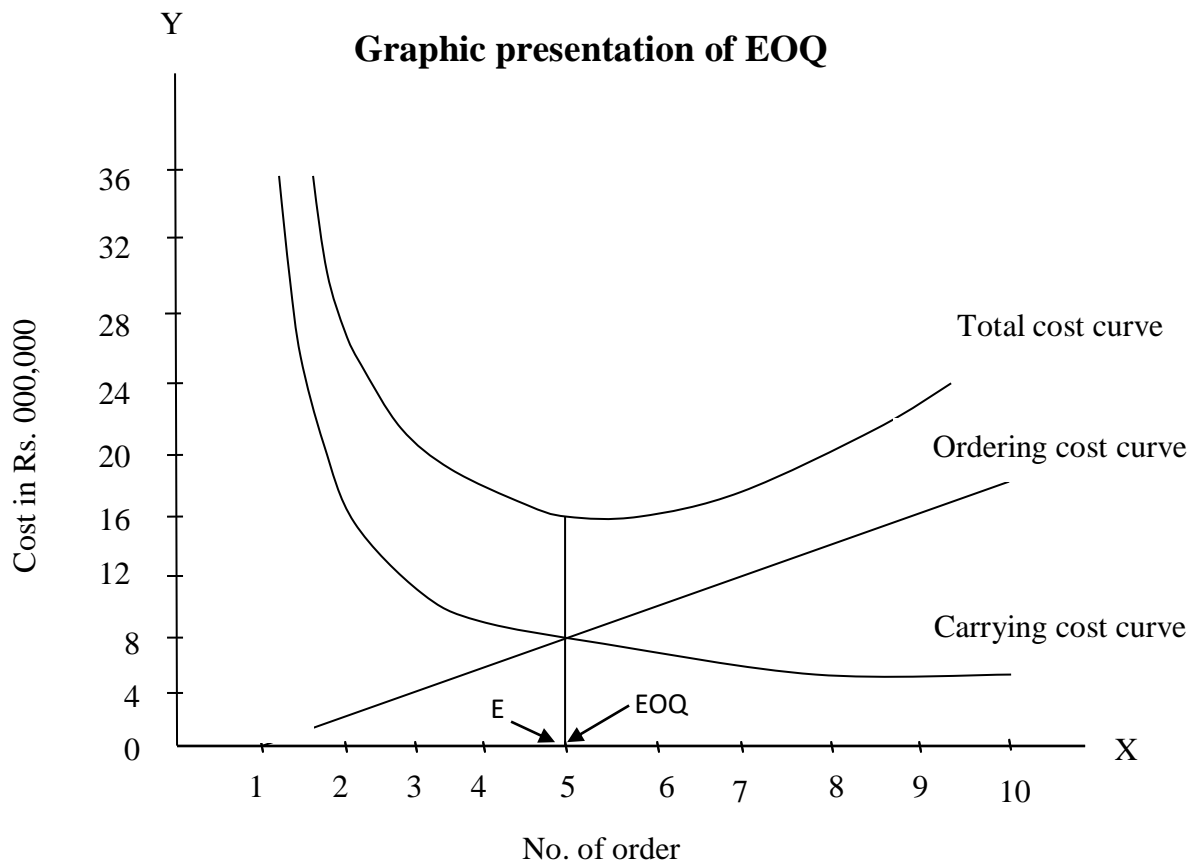
The above table shows different numbers of order from single order to ten numbers of orders. The ordering cost increase along with the number of orders but carrying cost is vice-versa. In five numbers of orders there are

almost equal both ordering and carrying cost where total cost is minimum.

III. Graphic Presentation of EOQ

Another important technique determining EOQ is graphic method. Here graphically presented the EOQ of petrol which are as follows:

Figure No. 4.3



In above figure, OX shows number of order & OY shows ordering cost, carrying cost and total cost. Ordering is increasing with the no of orders and carrying cost is decreasing along with no of orders. In five no. of orders there is equal both ordering and carrying cost and total cost is minimum which is known as EOQ point.

B. Diesel

The optimal level of Diesel has been determined by applying the different approach of EOQ model which are as follows:

I. Mathematical or formula method

To determine EOQ of Diesel the mathematical or formula approach is one important tool which is as follows:

Annual requirement (A) = 852,764 KL

Carrying cost (C) = Rs. 3180 per KL

Ordering Cost (O) = Rs. 56,300,000 per order

Note: Source: NOC Ltd. Central Office, Kathmandu

By applying EOQ formula:

$$\begin{aligned}\therefore \text{EOQ} &= \sqrt{\frac{2AO}{C}} \\ &= \sqrt{\frac{2 \times 852,764 \times 56,300,000}{3,180}} \\ &= 152,031.55 \text{ KL}\end{aligned}$$

$$\therefore \text{EOQ} = 152,031.55 \text{ KL}$$

$$\begin{aligned}\text{No. of order} &= \frac{\text{Annual requirement}}{\text{EOQ}} \\ &= \frac{852,764}{152,031.55} \\ &= 4.29 \approx 5 \text{ times}\end{aligned}$$

From above calculation we can concluded that, the EOQ is 152,031.55 KL and no. of orders is 4 times, where NOC can reduce total cost (i.e. total carrying cost and total ordering cost).

II. Trial and error approach or table method

Trial and error approach or table method is another important method of determining EOQ. Under this method we can calculate optimal level quantity of Diesel as follows:

Table No. 4.5

Trial and error approach or table method of EOQ

No. of order	Order size in KL	Average inventory in KL	Total carrying cost (Rs.)	Total Ordering cost (Rs.)	Total cost (Rs.)
1	652,764	326,382	1,037,894,760	56,300,000	1,094,194,760
2	326,382	161,191	518,947,380	112,600,000	631,547,380
5	130,553	65,276	207,577,690	281,500,000	489,077,690
6	108,794	54,397	172,982,460	337,800,000	510,782,460
8	81,595	40,798	129,737,640	450,400,000	580,137,640

Source: NOC Ltd. Central Office, Kathmandu

Note:

$$\text{Average inventory} = \frac{\text{Order Size}}{2}$$

$$\text{Carrying Cost} = \text{Average inventory} \times \text{Carrying cost per KL}$$

$$\text{Ordering Cost} = \text{No. of order} \times \text{Ordering cost per order}$$

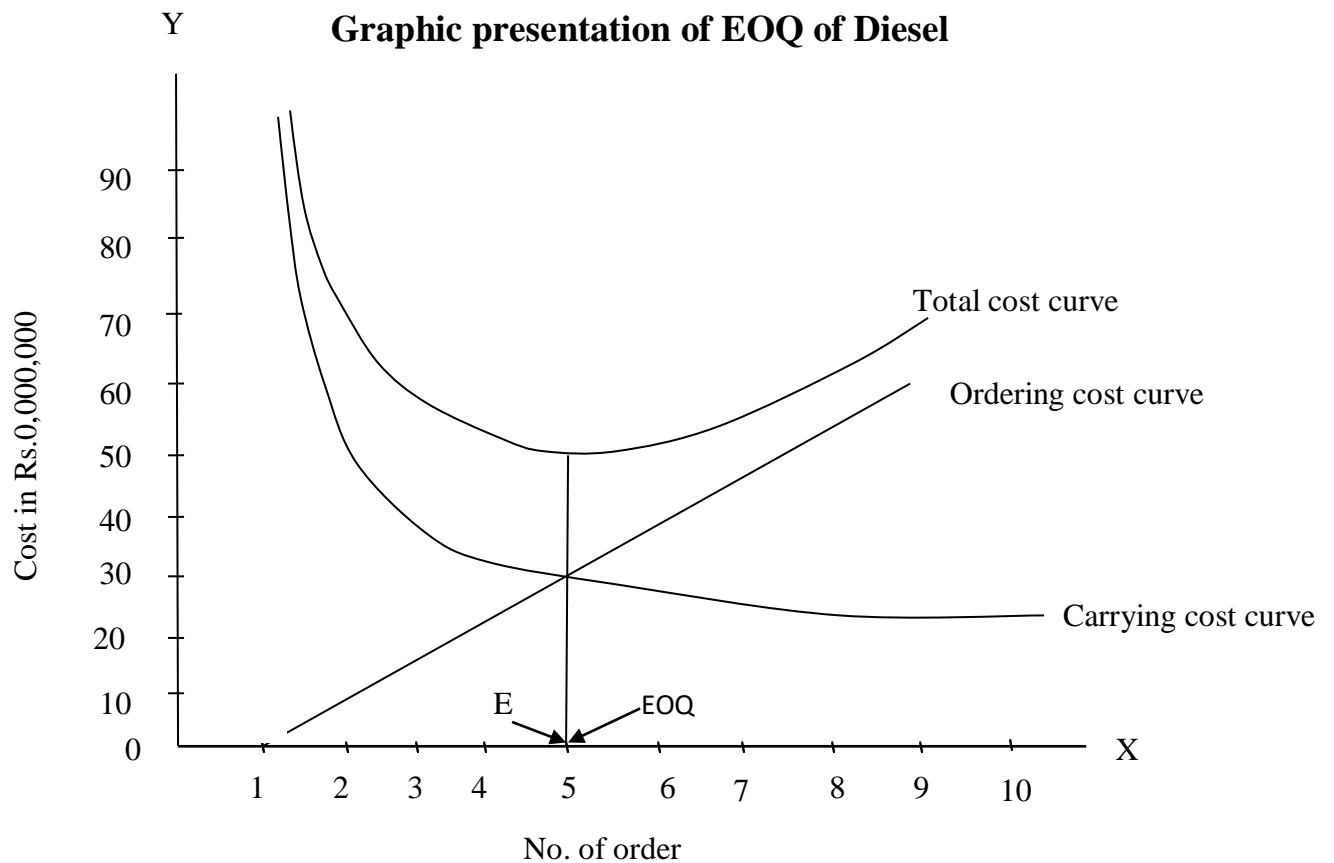
$$\text{Total Cost} = \text{Total Ordering Cost} + \text{Total Carrying Cost}$$

The above table shows different numbers of order, order size and there relevant cost. Where ordering cost is increasing along with number of order but carrying cost is increasing along with the order size. When no. of order is five there is almost equal total ordering cost and total cost (i.e. total carrying cost + total cost) is minimum, that point is known as EOQ point.

III. Graphic Approach of EOQ

Another important approach of determining EOQ is graphic approach. The graphic presentation of EOQ of Diesel is as follows:

Figure No. 4.4



In above figure OY shows cost and ox shows different no. of orders and there is presented ordering cost curve, carrying cost curve and total cost curve. At point E, there both ordering cost and carrying cost are equal and total cost is minimum where no. of orders is five and it is known as EOQ point.

C. Kerosene

In course of inventory management NOC's petroleum product kerosene, the optimal level of kerosene, we can determine by applying different tools and technique of EOQ models which are as follows:

I. Mathematical or formula method

In course of determining optimal level or EOQ of kerosene one important and applicable approach is mathematical or formula approach which is presented as follows:

Annual requirement (A) = 43,399 KL

Carrying cost (C) = Rs. 3,460 per KL

Ordering Cost (O) = Rs. 3,700,000 per order

Note: Source: NOC Ltd. Central Office, Kathmandu

By applying economic order quantity formula:

$$\begin{aligned}\therefore \text{EOQ} &= \sqrt{\frac{2AO}{C}} \\ &= \sqrt{\frac{2 \times 43,399 \times 3,700,000}{3,460}} \\ &= 9,634.24 \text{ KL} \\ \therefore \text{EOQ} &= 9,634.24 \text{ KL}\end{aligned}$$

$$\begin{aligned}\text{No. of order} &= \frac{\text{Annual requirement}}{\text{EOQ}} \\ &= \frac{43,399}{9,634.24} \\ &= 4.5 \approx 5 \text{ times}\end{aligned}$$

In above calculation the EOQ is 9,634.24 KL and no. of orders is 5 times, where NOC can reduce total cost (i.e. total carrying cost and total ordering cost).

II. Trial and error approach or table method

Trial and error approach or table method is another one important tool and technique of determining optimal level of kerosene which is as follows:

Table No. 4.6

Trial and error approach or table method of EOQ

No. of order	Order size in KL	Average inventory in KL	Total carrying cost (Rs.)	Total Ordering cost (Rs.)	Total cost (Rs.)
1	43,399	21,700	75,082,000	3,700,000	78,782,000
3	14,466	7,233	25,026,180	11,100,000	36,126,180
5	8,680	4,340	15,016,400	18,500,000	33,516,400
7	6,200	3,100	10,726,000	25,900,000	36,626,000
10	4,340	2,170	7,508,200	37,000,000	44,508,200

Source: NOC Annual Central Office Kathmandu

Note:

$$\text{Average inventory} = \frac{\text{Order Size}}{2}$$

$$\text{Carrying Cost} = \text{Average inventory} \times \text{Carrying cost per KL}$$

$$\text{Ordering Cost} = \text{No. of order} \times \text{Ordering cost per order}$$

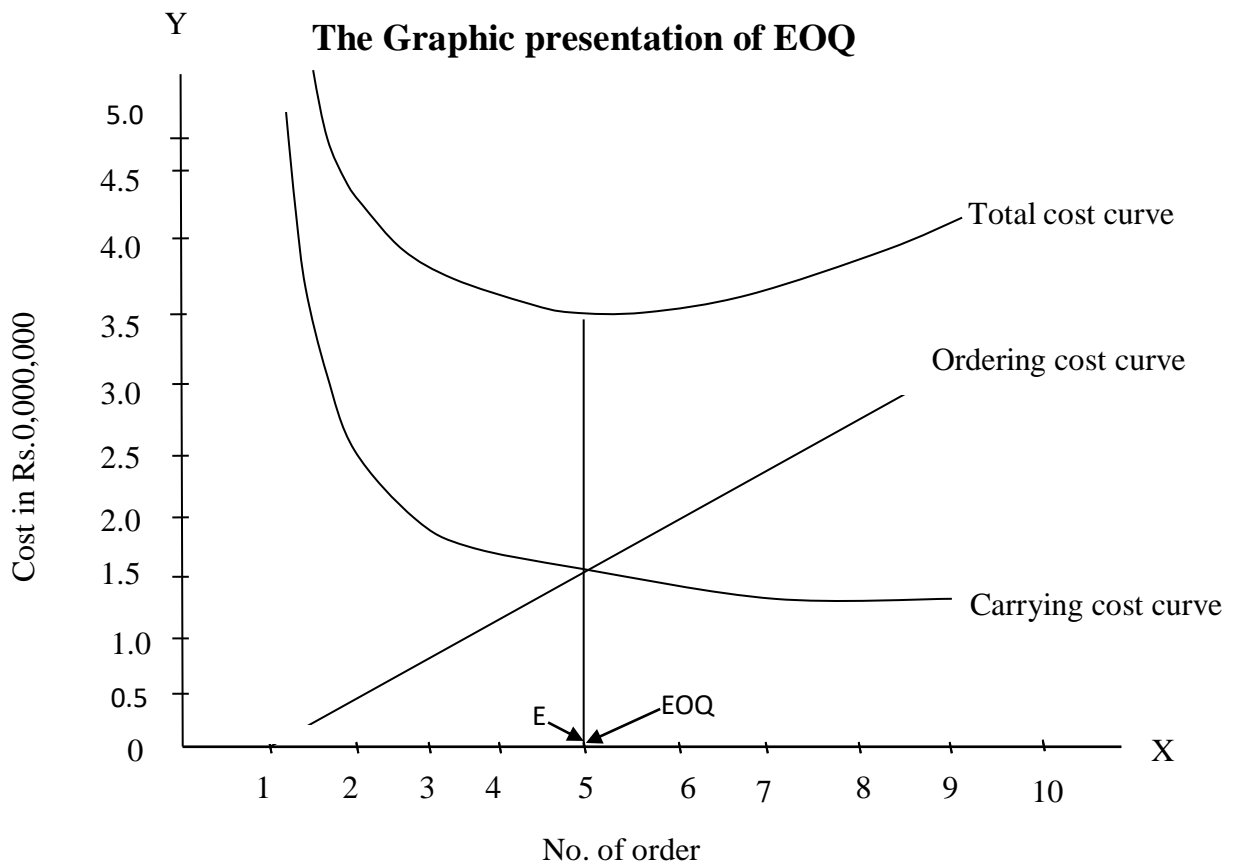
$$\text{Total Cost} = \text{Total Ordering Cost} + \text{Total Carrying Cost}$$

The above table shows different numbers of order, order size and there relevant cost, where ordering cost is increasing along with number of order but carrying cost is increasing along with the order size. When no. of order is 5 the total cost (i.e. total carrying cost + total cost) is minimum, that point is known as EOQ point.

III. Graphic approach of EOQ

Another important and applicable approach of determining EOQ is known as graphic approach. The graphic presentation of kerosene for determining EOQ is as follows:

Figure No. 4.5



In above figure no. of orders and cost are presented by OX and OY and similarly ordering cost curve, carrying cost curve and total cost curve are also presented. At point E there is ordering cost and carrying cost are equal and total cost is minimum where no. of order is five and it is known as EOQ point.

4.7 Re-order point

Re-order point is that level of inventory the firm places an order with the firm places and order with the suppliers for procuring additional inventory equal to EOQ when the inventory reaches the re-order point. The researcher try to analyze the re-order point of petroleum product on the basis of lead time safety stock kept by the company as well as daily consumption rate of 5 years i.e. fiscal year 2063/64 to 2067/68.

A. Petrol

Re-order point of petrol from FY 2063/64 to 2067/68 is as follows

Table No. 4.7

Calculation of re-order point of petrol

Fiscal Year	Usage rate in (KL)	Lead time in (days)	Re-order Point in (KL)	Safety stock in (KL)	Re-order point in (KL)
2063/64	279.21	2	558.42	$\sqrt{558.42} = 23.63$	582.05
2064/65	276.28	2	552.56	$\sqrt{552.56} = 23.51$	576.07
2065/66	340.19	2	680.38	$\sqrt{680.38} = 26.08$	706.46
2066/67	444.59	2	889.18	$\sqrt{889.18} = 29.82$	919.00
2067/68	514.08	2	1028.16	$\sqrt{1028.16} = 32.06$	1060.22
Average	370.87	2	741.74	$\sqrt{741.74} = 27.23$	768.97

Source: NOC Ltd. Central Office Kathmandu

Note:

$$\text{Usage rate} = \frac{\text{Annual requirement}}{\text{Days in years}}$$

Safety stock lead time = Square root of average consumption during the lead time

The above table shows usage rate, lead time safety stock lead time and re-order point with safety stock and without safety stock. There is minimum re-order point including safety stock and excluding safety stock are 576.07 KL and 552.56 KL in fiscal year 2064/65 and maximum re-order point including safety stock and excluding safety stock are 1,060.22 KL and 1,028.16 KL in FY 2067/68.

B. Diesel

The reaches want to know the re-order point of diesel from fiscal year 2067/68 is as follows:

Table No. 4.8

Calculation of re-order point of Diesel

Fiscal Year	Usage rate in (KL)	Lead time in (days)	Re-order Point in (KL)	Safety stock in (KL)	Re-order point in (KL)
2063/64	840.23	2	1,680.46	$\sqrt{1,680.46} = 40.99$	1,721.45
2064/65	829.23	2	1,658.66	$\sqrt{1,658.66} = 40.73$	1,699.39
2065/66	1,277.99	2	2,555.98	$\sqrt{2,555.98} = 50.56$	2,606.54
2066/67	1,678.10	2	3,356.20	$\sqrt{3,356.20} = 57.93$	3,414.13
2067/68	1,794.87	2	3,589.74	$\sqrt{3,589.74} = 59.91$	3,639.56
Average	1,284.08	2	2,568.17	$\sqrt{2,568.17} = 50.68$	2,618.85

Source: NOC Ltd. Central Office Kathmandu

Note:

$$\text{Usage rate} = \frac{\text{Annual requirement}}{\text{Days in years}}$$

Safety stock lead time = Square root of average consumption during the lead time

The above table shows delay consumption, lead time, safety stock lead time and re-order period without safety stock and with safety stock in different year. The minimum re-order period with safety stock and without safety stock are 1,658.66 KL and 1,699.39 KL in fiscal year 2064/65 and maximum re-order point with safety stock and without safety stock are 3,649.65 KL and 3,589.74 KL in fiscal year 2067/68.

C. Kerosene

The reaches want to know the re-order point of kerosene of different five fiscal year which are presented in following table.

Table No. 4.9

Calculation of re-order point of kerosene

Fiscal Year	Usage rate in (KL)	Lead time in (days)	Re-order Point in (KL)	Safety stock in (KL)	Re-order point in (KL)
2063/64	542.05	2	1,084.10	$\sqrt{1,084.10} = 32.93$	1,117.03
2064/65	425.25	2	850.50	$\sqrt{850.50} = 29.16$	879.66
2065/66	192.02	2	384.04	$\sqrt{384.04} = 19.60$	403.64
2066/67	152.83	2	305.66	$\sqrt{305.66} = 17.48$	323.14
2067/68	135.60	2	271.20	$\sqrt{271.20} = 16.47$	287.67
Average	282.55	2	579.10	$\sqrt{579.10} = 24.06$	603.16

Source: NOC Ltd. Central Office Kathmandu

Note:

$$\text{Usage rate} = \frac{\text{Annual requirement}}{\text{Days in years}}$$

Safety stock lead time = Square root of average consumption during the lead time

The above re-order period table shows usage rate, lead time, safety stock lead time and re-order point along with safety stock and without safety stock. The maximum re-ordered point with safety stock and without safety stock are 1,117.03 KL and 1,084.10 KL in economic year 2063/64 and the minimum re-ordered point with safety stock and without safety stock are 287.67 KL and 271.20 KL in fiscal year 2067/68.

D. Aviation Fuel

The researcher want to know the re-ordered point of aviation fuel from fiscal year 2063/64 to 2067/68 are as follows:

Table No. 4.10

Calculation of re-order point of Aviation Fuel

Fiscal Year	Usage rate in (KL)	Lead time in (days)	Re-order Point in (KL)	Safety stock in (KL)	Re-order point in (KL)
2063/64	174.38	2	348.76	$\sqrt{348.76} = 18.68$	367.44
2064/65	187.76	2	375.52	$\sqrt{375.52} = 19.38$	394.90
2065/66	203.52	2	407.04	$\sqrt{407.04} = 20.18$	427.22
2066/67	226.92	2	453.84	$\sqrt{453.84} = 21.30$	475.14
2067/68	273.95	2	547.91	$\sqrt{547.91} = 23.41$	571.32
Average	213.31	2	426.61	$\sqrt{426.61} = 20.65$	447.26

Source: NOC Ltd. Central Office, Kathmandu

Note:

$$\text{Usage rate} = \frac{\text{Annual requirement}}{\text{Days in years}}$$

Safety stock lead time = Square root of average consumption during the lead time

The above table shows usage rate, lead time, safety stock lead time and re-order period without safety stock and with safety stock in different year. The maximum re-order point with safety stock and without safety stock are 571.32 KL and 547.90 KL in fiscal year 2067/68 and minimum re-order point with safety stock and without safety stock are 367.44 KL and 348.76 KL in fiscal year 2063/64.

4.8 Trend analysis of inventories

Inventory means stock of goods or material hold by organization for smooth run and operation of organization. Trend analysis of inventory means analysis of inventory level hold by organization and operation of organization. Here we analyze the inventory level of different kind of

petroleum product hold by NOC in different time period which are as follows.

4.8.1 Trend analysis of inventory of petrol

The level of inventory of petrol hold by NOC in different time period from fiscal year 2063/64 to 2067/68 are as follows.

Table No. 4.11

Inventory level of petrol

(In kilo liter)

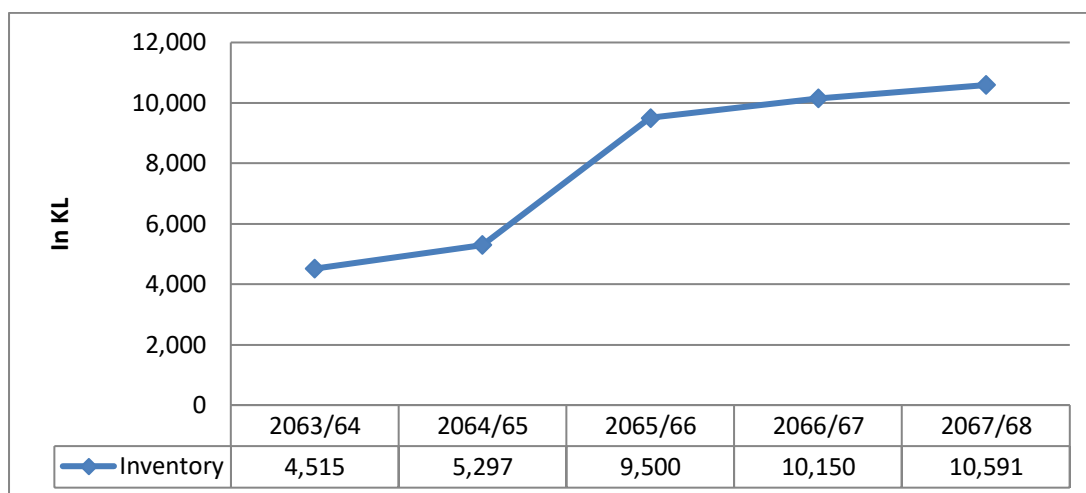
Fiscal Year	Inventory
2063/64	4,515
2064/65	5,297
2065/66	9,500
2066/67	10,150
2067/68	10,591

Source: NOC Ltd. Central Office Kathmandu.

The above table shows that the levels of inventory of petrol from fiscal year 2063/64 to 2067/68 are 4,515KL, 5,297KL, 9,500KL, 10,150KL and 10,591KL respectively. The levels of inventory of petrol are in increasing rate and in fiscal year 2065/66 it is very high. For more clearly graphic figure are as follows:

Figure No. 4.6

Trend analysis of inventory of petrol



The above figure shows inventory levels of petrol are in increasing and in fiscal year it in very high rate then other fiscal year.

4.8.2 Trend analysis of inventory of diesel

The levels of inventory of diesel hold by NOC in different time period from fiscal year 2063/64 to 2067/68 are as follows;

Table No. 4.12

Inventory level of diesel

(In kilo liter)

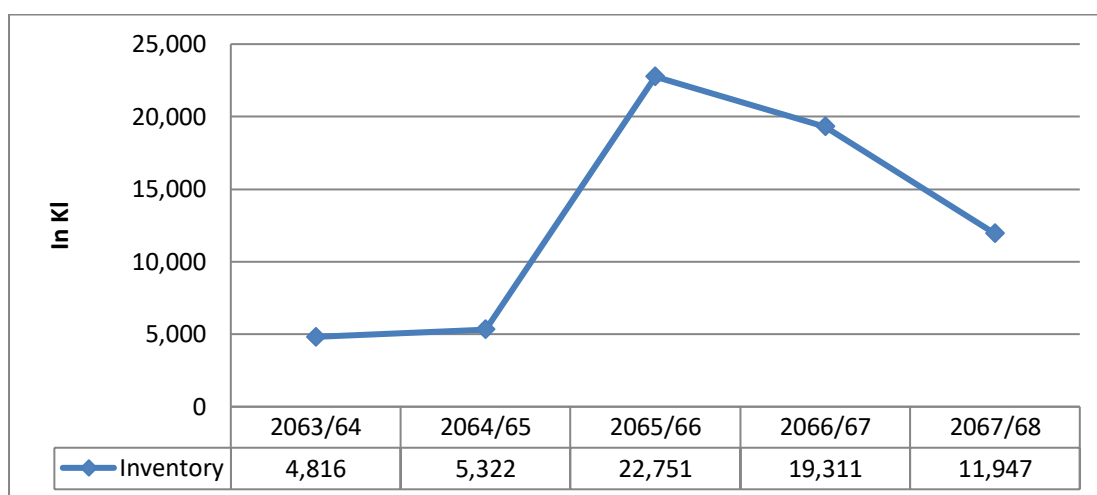
Fiscal Year	Inventory
2063/64	4,816
2064/65	5,322
2065/66	22,751
2066/67	19,311
2067/68	11,947

Source: NOC Ltd. Central Office Kathmandu.

The above table shows that the levels of inventory of diesel from fiscal year 2063/64 to 2067/68 are 4,816KL, 5,322KL, 22,751KL, 10,150KL and 18,311KL respectively. For more clearly graphic figure are as follows:

Figure No. 4.7

Trend analysis of inventory of diesel



From the above figure we know that the level of inventory of diesel are increasing rate at beginning and decreasing rate at ending but increasing rate in fiscal year 2065/66 are very high and which is almost more than four times.

4.8.3 Trend analysis of inventory of kerosene

The different levels of inventory of kerosene in different time period from fiscal year 2063/64 to 2067/68 are as follows:

Table No. 4.13

Inventory level of kerosene

(In kilo liter)

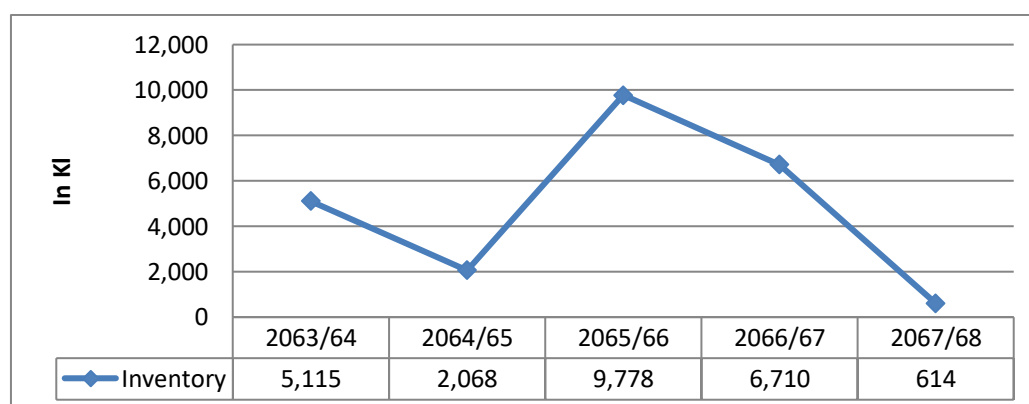
Fiscal Year	Inventory
2063/64	5,115
2064/65	2,068
2065/66	9,778
2066/67	6,710
2067/68	614

Source: NOC Ltd. Central Office Kathmandu.

The above table shows that the level of inventory of kerosene in different time period from fiscal year 2063/64 to 2067/68 is 5115KL, 2068KL, 9778KL, 6710KL and 614KL respectively. For more clearly graphic figure are as follows:

Figure No. 4.8

Trend analysis of inventory of Kerosene



From above figure we know that the level of inventory of kerosene are sometime increasing and sometime decreasing but coming in present the decreasing rate are very high then other fiscal year.

4.8.4 Trend analysis of inventory of aviation fuel

The different levels of inventory of aviation fuel hold by NOC in different time period from fiscal year 2063/64 to 2067/68 are as follows:

Table No. 4.14

Inventory level of aviation fuel

(In kilo liter)

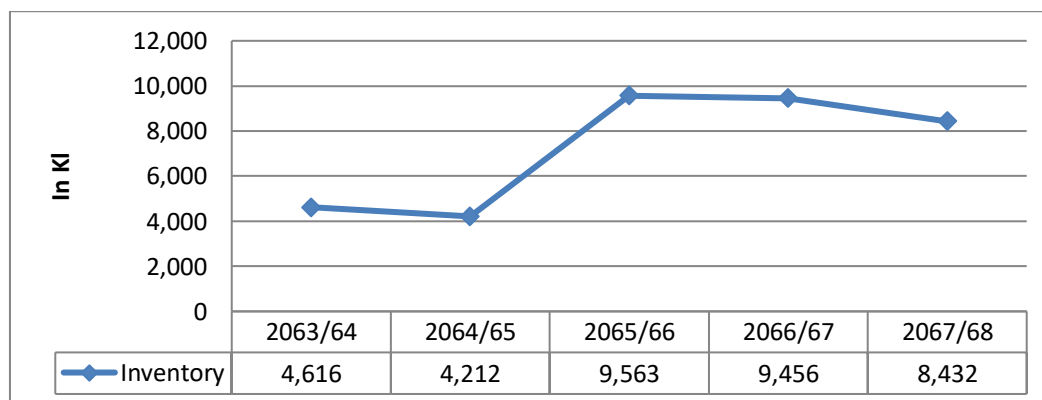
Fiscal Year	Inventory
2063/64	4,616
2064/65	4,212
2065/66	9,563
2066/67	9,456
2067/68	8,432

Source: NOC Ltd. Central Office Kathmandu.

The above table shows that the level of inventory of kerosene in different time period from fiscal year 2063/64 to 2067/68 is 4,616KL, 4,212KL, 9,563KL, 9,456KL and 8,432KL respectively. For more clearly graphic figure are as follows:

Figure No. 4.9

Trend analysis of inventory of aviation fuel



From above figure it shows that the inventory level of aviation fuel of NOC are sometime in increasing and sometime decreasing. In fiscal year 2065/66 increasing rate of inventory level are very high but in other year the variation are in normal.

4.8.5 Trend analysis of inventory in total

The different level of inventory in total hold by NOC in different time period from fiscal year 2063/64 to 206/68 is as follows:

Table No. 4.15

Inventory level of petroleum product

(In kilo liter)

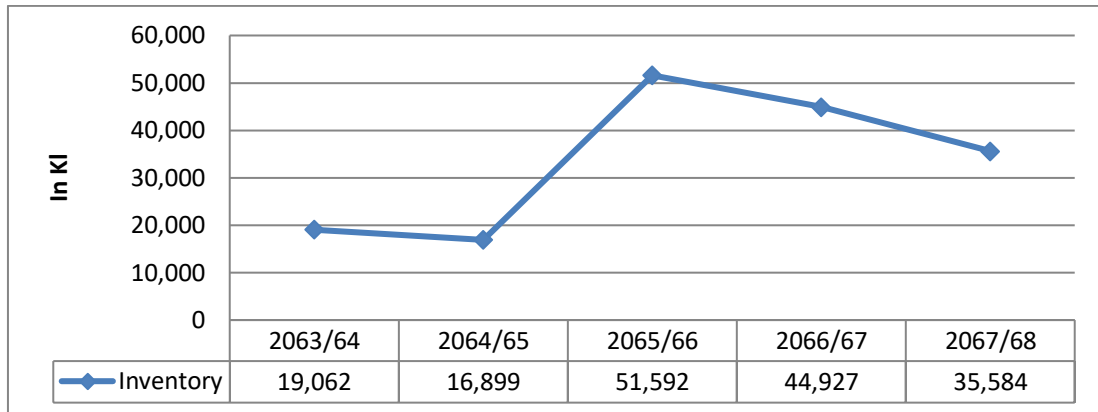
Fiscal Year	Inventory
2063/64	19,062
2064/65	16,899
2065/66	51,592
2066/67	44,927
2067/68	35,584

Source: NOC Ltd. Central Office Kathmandu.

The above table shows that the level of inventory of kerosene in different time period from fiscal year 2063/64 to 2067/68 is 19,062KL, 16,899KL, 51,592KL, 44,927KL and 35,584KL respectively. For more clearly graphic figure are as follows:

Figure No. 4.10

Trend analysis of inventory in total



The above figure shows the level of inventory are in decreasing rate in beginning time period and coming in ending time period but in fiscal year 2065/66 it is increasing rate, the is almost more hen 3 times.

4.9 Storage facility

Storing is the back bone of inventory management. Good storage helps to maintain the quality of the goods, smoothness in sales, facilitate production process, provide well service to customer and grasps the opportunity.

While discussing location, size etc. of the store number of factors is consideration as follows.

- Value of stock transaction
- Type of stock
- Volume of stock to be hold at any time
- Amount of handling , re-handling and extent of transport involved
- Security
- Safety requirement

In order to distribute petroleum product throughout the nation NOC has build storage tanks in different center. Few years ago there wave store

tanks to store up to 31 thousand kilo liters with NOC. Which was only able to fulfill the demand for 15 days? For not top depend upon such minimum capacity of storage facility. Particularly for the land locked country like Nepal. NOC received the loan from ADB to construct the extra storage capacity. NOC has now expanded its storage capacity to nearly 72 thousand kilo liters. This can fulfill the demand of petroleum product at least for 15 days. In order to meet the demand increase every year by 10%-12% become necessary for NOC to further invest in this area. Now NOC has storage capacity according the following data.

Table NO. 4.16

Description of NOC's storage capacity

(In kilo liters)

Place	Petrol	Diesel	Kerosene	Jet A1	Total
Kathmandu	1,870	8,400	4,960	7,710	22,940
Amlekhgunj	1,960	16,100	5,580	-	23,640
Biratnagar	560	140	2,180	280	11,530
Janakpur	30	3,055	70	-	240
Bhairahawa	140	2,280	394	60	3,649
Pokhara	350	2,280	760	64	3454
Nepalgunj	140	-	760	280	150
Surkhet	-	1590	45	60	2,480
Dhangadi	85	-	760	45	60
Dipayal	-	15	45	-	
Total	5,135	41,610	16,314	8,499	71,558

Source: NOC limited central office

The extra storage capacity tanks have been constructed in Amlekhgunj, Thankot, Tribhuvan Airport (Sinamangal) with the loan of Asian Development Bank (ADB). These storage facilities of petroleum products are in operation. Which are as follows:

Table No. 4.17

Storage tanks constructed by ADB support

(In kilo liters)

Place	Petrol	Diesel	Kerosene	Aviation Fuel
Amlekhgung	760	4,100	5,600	-
Thankot	1,520	6,300	7,060	-
Pokhara	140	1,520	1,520	210
Airport	-	-	-	1,600
Total	2,420	11,920	14,180	1,810

Source: NOC limited central office

The increase in storage capacity over the years in line with the growth in the demand of petroleum product is quite impressive. The present storage capacity of 71558 kilo liters is however, just enough for 15 days national sales based on the projected sales for 2009. To maintain the same level of storage facilities NOC has to constantly increase its storage facilities. Therefore the NOC management is giving adequate attention to the of storage facilities currently, it is working towards developing storage facilities for petroleum products to meet the demand of at list 30 days.

4.10 Distribution system of petroleum products

To meet national requirement in easier and fastest way following. Indo Nepal areas have been used for distribution of petroleum products for different regions.

For Eastern Region

Barauni Refinery

For Central Region

Raxual Depot

For Western Region

Betalpur Depot, Mugalsari Terminal

For Mid Western Region

Allahabad Ternimal, Gonda Depot

For Far Western Region Banthara Depot

In order to sell and distribute various petroleum product throughout nation of Nepal the five regional branches have been established in Biratnagar, Birgunj, Siddhartha Nagar, Nepalgunj and Dhangadi representing eastern, centre, mid-western and far-western region respectively. There are central fuel depots in Kathmandu and Amlekhgunj and branch depots in Birtamod, Surkhet, Dang and Dipayal whereas Aviation Fuel is distributed by NOC itself. NOC provides Aviation Fuel for national and international flights from Kathmandu and Aviation Fuel for internal flights is provided from Biratnagar, Pokhara, Bhairahawa, Nepalgunj, Surkhet and Dhangadi also.

In order to check the possible storage of petroleum product throughout the kingdom NOC has manage to provide necessary fuel through their distributors on the basis of demand and necessity of petroleum product in different regions. NOC has managed its distributor according to table below.

Table No. 4.18

Oil distribution network of NOC

Region	General distribution	Packed distribution	Kerosene distribution	Total number
Eastern	131	91	64	286
Central	338	96	399	833
Western	204	65	57	326
Mid-western	55	15	49	119
Far-western	70	43	3	12
Total	738	310	577	1685

Source: NOC Ltd. Central Office, Kathmandu

For distribution of petroleum product NOC has operated 841 tankers, 118 in eastern, 486 in central, 137 in western, 62 in mid-western and 38 in far-western development region.

In this way petroleum has been distributed in five development regions. Especially, hilly districts and inaccessible districts are beyond from the access of dealers. Tanker is the only way to provide petroleum product throughout the nation. Especially there is urgent need of alternative means for transportation of petroleum products from India because Nepal often suffers oil crisis.

On the other hand the demand of LPG (Liquefied petroleum gas) use for household (Cooking), commercial and industrial purpose and it is in increasing rate day by day. In this context NOC has been providing LPG through different gas authorities throughout the nation. LPG is currently imported from IOC but in case of technical break down Nepal suffers LPG crisis. There has not been conducted any studies.

4.11 Quality Control

Quality control is a process of establishing acceptable limits of variation in size, weight and so on for product or services and of maintaining the resulting goods or services within this limit. In these days of radically changing circumstances quality has been overriding factor in corporate success. In order to maintain improved corporate image and responsibility in giving quality assurance has become the most important factor. The attainment of quality reputation calls for careful development and effective implementation of quality system. Quality philosophy is gradually changing from quality control to quality assurance and forms quality control to quality assurance by shifting the focus from product to process and from process to system. In this context traditional quality control is no longer sufficient to ensure future success of one's business.

In context of NOC it is more relevant as at present it is having a monopolistic type of business of direct public concern. Tomorrow the situation may not remain as for today with the present government policy on parallel marketing unionization. Those who can't deliver good services and quality will have to struggle very hard even for mere survival. Talking in to consideration of these bitters facts, NOC has already started gearing a improvement and developing update a quality product to met consumer satisfaction.

To keep the quality of the petroleum product in predetermined specification, the quantity control department has been formed by N OC. In 2050Magh 7th a committee including the authorize reprehensive of quality control department of NOC determined the quality specifications as pre Nepal quality control act. According to the process, different method to check the quality of petroleum product has also been applied.

The task of quality control has become more radical to NOC as one of the reasons pointed out for the pollution is the quality of the fuels. For the better performance loving of engine better fuel whether gasoline diesel or any other fuel is needed in recent days, better performance not only relates to better mileage, lesser repair and maintenance cost but also a better combustion. The later is reflected in lesser pollution so quality of fuel is directly or indirectly related to environment.

4.11.1 Quality control procedure

The quality of product loaded at load port for dispatch under the terms and conditions mention in the accepted tender the terms and conditions mention in the accepted tender is carried out in two stages.

At the load load port by any one of the three internationally recognized petroleum surveyors namely SGS, calebbret and saubalt. The complete

quality survey report/result of the cargo. After thoroughly checking of the results by the corporation passed on to Indian Oil Corporation (IOC) who in crush goes through the test results comparing the results. Upon completion of voyage the cargo vessel anchor at the pre specified in the storage tanks.

At the unloaded part prior to unloading the vessel the product checks and verification by the disport behalf of NOC. Only after being assured with the survey results for both quality and quantity the production is accepted and decanted in the store tanks by IOC.

Under the provision made in existing contract agreements between NOC and IOC. IOC takes up the entire product and IOC pays the cargo value back to NOC. At the time and manner indicated in the contract document.

The product is dispatched from IOC's refinery distained to be delivered to NOC is first reached to IOC's respective full terminates located near the Indo-Nepal border. NOC arrange for placement of its tanks Lorries at these terminates for loading the required grade of petroleum product. After completing the loading of the tank Lorries the quality of the product is ascertained by checking the composite density range and the corresponding loading temperature of the same time. Two copies of sample are drawn out of the loading tank and sent to the respective unloading (receiving) depot for necessary verification and formal receiving of the product from the transporter.

At the receiving location the density and the temperature of the product transported by the tank Lorry is checked and noted. Individual chamber wise sample of the product is also taken from the Lorry. The density observed at both the dispatching and receiving location is converted into 15°c and the different is observed. In case of gas alive distillation test is also carried out in the laboratory and unadulterated products come within

density difference range (+/-) 0.0025 and final boiling point range within (+/-) 4°c taken as instrument error and altitude variation. However, if the difference tends to exceed then the concerned dealer/transporter is penalized as per the act.

NOC head office base laboratory is equipped with necessary facilities for testing quality standards of petroleum, product. Laboratory testing is regularly carried out and quality norms are strictly adhered to NOC has arranged a mobile van to check and maintain the quality of petroleum products. NOC has reactivated its quality control squad and the squad frequently goes for surprise check, takes the sample, analysis them and cites the cheater. The squad often reads about certain petroleum pumps which have been penalized by the corporation. Under the penalty provision of its regulations, fuel supply to dealer may be suspended for six months, the dealer may be fined up to Rs, 75,000 and the dealer may be revoked. Mixing kerosene to petrol was popular. The colorless kerosene mixes well with petrol and adulteration is not visible. To prevent this, NOC has introduced blue dyed kerosene in the market.

In order to ensure quality of petroleum products, NOC has established separate quality and pollution control department in higher level. This department all aspects of NOC's service organization function, continuing to apply rigorous quality standards of its products.

4.12 MAJOR FINDINGS

On the basis of data presentation and their analysis the most remarkable findings related to this study have been presented below.

1. The economic ordered quantity of different products of NOC in fiscal year 2067/068 is 35969.60KL, 152,031.55 KL, & 9,634.24

KL, of petrol, diesel and kerosene respectively. If NOC apply this method in course of inventory management he can reduce cost.

2. The no. of orders of NOC's petroleum products petrol, diesel, and kerosene are 5 times, 4 times and 5 times in fiscal year 2067/068 where NOC can reduce cost.
3. Re-order point of NOC's petroleum products petrol, diesel, kerosene and aviation fuel are 741.74 KL, 2,568.17 KL, 579.10 KL and 426.61 KL respectively if NOC does not maintain safety stock and similarly 768.97 KL, 2,618.85 KL, 603.16 KL and 447.26 KL respectively if NOC maintain safety stock
4. NOC has constructed storage tanks in different places to smooth service. The present storage capacity of petroleum product is 71558 KL which is just for 15 days. This is not enough to smooth service.
5. NOC imports it different product through different Indo-Nepal areas and it distributes by 1685 dipos but which are concentrated in urban area not in remote areas in course of giving service.
6. Inventory turnover ratio of NOC seems good but there may problem in smooth supply of petroleum product and may increase in cost being high ordering cost.
7. Coming in present there variation between estimated inventory and actual inventory is very large, actual inventory are not according to planned inventory which may create problem in smooth supply of petroleum product according to public demand in course of give effective service.
8. The trend analysis of inventory shows that the inventory level are in increasing trend in an average.
9. The Nepal Oil Corporation has been established higher level of separate quality and pollution control department in order to ensure

quality of petroleum product. This separate unit is not completely successful to ensure quality.

10. In the conclusion, NOC is not applying scientific techniques of inventory management which is most crucial point in NOC. There may be several internal and external causes not to be used scientific techniques however it is sure NOC completely neglecting the inventory management concept. This is a matter of misfortune to the consumer as well as the whole nation.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATION

Most of the things about inventory management and introduction of this study have already been presented in the first chapter. In the second chapter the available literature on inventory management are reviewed. Moreover research methodology is described in the third chapter. All the available data are presented and analyzed in the fourth chapter relating to inventory decision by sorting out issues of inventory management of the corporation.

In this concluding chapter an attempt has been made to present summary, major finding and suggestion.

5.1 SUMMARY

Nepal Oil Corporation is one of the largest of public enterprises in nation. It was established in 2027-09-26 under the company act 2021, as a state owned trading enterprises to fulfill the fourth five years national periodic plan objectives. It has been supplying continuously vital commodity to the nations and this has been making significant contribution to the economic development of the country.

Since Nepal has no sources of petroleum product of its owns, all products have to be imported from foreign countries. Different kinds of petroleum products have been important for domestic use, industries and transport.

Initially it acted only dealer of foreign countries but in 1972 (2020) entered the business of importing petroleum oil and lubricant product on its own. Heralding a new phase in the history of petroleum oil and lubricant business in the country. For our four decades, NOC is the only one supplier of petroleum products in the country. Supply and distribution of lubricant is hand over to private sector organization. NOC,

however still remains the only one importer of major petroleum products in the country.

Most of the manufacturing and trading company invests a huge amount of capital in the form of inventory. NOC also invest a huge amount of capital in the form of inventory, the concept of inventory management is almost void in NOC, and they are not applying the scientific techniques of inventory management which is the short sight, unskilled, inexperience, inability and unknown manner of management aspect.

This basic problem of this study is examining the inventory management system that is exercised by the NOC. The main objectives of the study are to know the present situation and to identify the problem of inventory management faced by NOC and provides suggestion on the basis of study. For this purpose the researcher interviewed with officials and observed the inventory system personally.

1. The present practice of petroleum fuel import by NOC basically from two major systems i.e. import of bulk cargo vessel of gas oil and Kerosene from overseas international supplier under international telex bidding and import of entire varieties of petroleum fuel of different application from IOC under periodic contract basis.
2. Inventory turnover ratio in total display that maximum turnover ratio is 37.14 times in FY 2064/65 and minimum turnover ratio is 14.14 in FY 2065/66.
3. The economic ordered quantity of different products of NOC in fiscal year 2067/068 is 35969.60KL, 152,031.55 KL, & 9,634.24 KL, of petrol, diesel and kerosene respectively.

4. The no. of orders of NOC's petroleum products petrol, diesel, and kerosene are 5 times, 4 times and 5 times in fiscal year 2067/068 where NOC can reduce cost.
5. Re-order point of NOC's petroleum products petrol, diesel, kerosene and aviation fuel are 741.74 KL, 2,568.17 KL, 579.10 KL and 426.61 KL respectively if NOC does not maintain safety stock and similarly 768.97 KL, 2,618.85 KL, 603.16 KL and 447.26 KL respectively if NOC maintain safety stock in an average to give smooth search.
6. The maximum storage capacity of NOC is 71558 KL which is sufficient to meet the demand of 15 days only and NOC distributed its different product throughout 1685 dipos in course of giving smooth service.

5.2 CONCLUSION

Re-order level of NOC's petroleum products petrol, diesel, kerosene and aviation fuel are 741.74 KL, 2568.17 KL, 579.10 KL and 426.61 KL respectively if NOC does not maintain safety stock similarly 768.97 KL, 2,618.85 KL, 6.3.16 KL and 447.26 KL respectively if NOC maintain safety stock. The optimal order size of different products of NOC in fiscal year 2067/68 is 35,969.80 KL, 152,031.55 KL, and 9,634.24 KL of petrol, diesel and kerosene. And similarly no of orders of petrol, diesel and kerosene are 5 times, 4 times and 5 times respectively.

NOC has constructed storage tanks in different places to smooth service. The present storage capacity of petroleum product is 71,558 KL which is just for 15 days. It distributes its petroleum product through 1685 dipos but which are concerned in urban area no in remote are in cause of giving service.

The trend analysis of inventory shows that the inventory level are increasing trend and coming in present the variation between estimated inventory and actual inventory is very large, actual inventory are not according to planned inventory which may create problem in smooth supply of petroleum product according to public demand in course of giving efficient service.

Inventory turnover ratio of NOC seems good but there may problem in smooth supply of petroleum product. In course of giving quality service the NOC has been established higher level of separate quality and pollution control department in order to ensure quality of petroleum product. This separate unit petroleum unit is not completely successful to ensure quality.

In the conclusion, NOC is not applying scientific techniques of inventory management which is most crucial point in NOC. There may be several internal and external causes not to be used scientific techniques however it is sure NOC completely neglecting the inventory management concept. This is a matter of misfortune to the consumer as well as the whole nation.

5.3 RECOMMENDATION

This study is a small part to fulfill the partial requirement of master degree. Analyzing available data some findings were extracted. Based on the major findings it may be appropriate to make some suggestion. Although these suggestion may not be adequate and could give very easily negative reflection. But it is hoped that these suggestion will help improving to the management of the corporation and other concerned offices, institutions and individuals.

1. The demand of petroleum products is in increasing rate day by day to meet this demand via Raxsual is impossible due to narrow road, traffic, strikes or geographic terrain so there is urgent need of complementary route for easy transportation. For this purpose there should be product pipe line from Ronshual to Amlekhgunj to avoid possible difficulties in near future.
2. NOC depots are concentrated only in urban areas. It has not able to distribute the available commodity to remote areas. Therefore the rural people are forced to use alternative means. So NOC should give attention in extending its service to the remoter area as well.
3. The variance between estimated closing stock and actual closing stock is very large. The reason may be due to normal loss like (Shrinkage, normal leakage, working loss etc. and abnormal loss like (Mishandling, accident and improper management etc.) NOC should effort to analyze and diagnose the abnormal losses in order to place the proper management.
4. There is massive increase in demand of petroleum products i.e. nearly 10/12% per year. However the storage capacity is just enough for fulfill of demand for 15 days. To give effective service NOC should expand its storage capacity.
5. NOC should attempt to scientific models like Economic Order Quantity (EOQ), ABC analysis, Reorder Level etc. So this will help solving the inventory problem such as over stock, under stock or out of stock will be solved. As a result NOC can deliver the regularly supply of petroleum fuels to the consumers at right quantity as reasonable price and right time.
6. Nepal Oil Corporation should tighten up its system and should be more concern with the fuel qualities. The inspection of the

corporation should be a hike field visit in the length and breadth of country in quality monitoring of the petroleum fuels.

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APPENDIX I

Total inventory of Nepal Oil Corporation Limited from fiscal year 2063/64 to 2067/68

Fiscal Year	Actual Inventory (in KL)	Planned Inventory (in KL)
2063/64	19,062	18.259
2064/65	16,899	19.551
2065/66	51,592	53.455
2066/67	44,927	56.563
2067/68	35,584	58.150

APPENDIX II

Inventory of petroleum products of Nepal Oil Corporation Limited from fiscal year 2063/64 to 2067/68

Fiscal Year	Inventory (in KL)			
	Petrol	Diesel	Kerosene	Aviation Fuel
2063/64	4,515	4,816	5,115	4,616
2064/65	5,297	5,322	2,068	4,212
2065/66	9,500	22,751	9,778	9,563
2066/67	10,150	19,311	6,710	9,456
2067/68	10,591	11,947	614	8,432

APPENDIX III

Purchase of petroleum products of Nepal Oil Corporation Limited from fiscal year 2063/64 to 2067/68

Fiscal Year	Purchase (in KL)			
	Petrol	Diesel	Kerosene	Aviation Fuel
2063/64	98,435	299,416	192,576	63,650
2064/65	101,624	303,212	152,168	68,534
2065/66	128,382	489,219	77,799	74,286
2066/67	162,926	608,065	52,714	82,824
2067/68	188,082	652,764	43,399	99,990

Table No. 4.1**Inventory Turnover Ratios of individual items of petroleum products**

(In kilo liters)

Fiscal Year	Petrol			Diesel			Kerosene	
	Sales	Closing Stock	ITR	Sales	Closing Stock	ITR	Sales	Closing Stock
2063/64	101,912	4,515	23	306,687	4,816	64	197,850	5,115
2064/65	100,824	5,297	19	302,706	5,322	57	155,215	2,068
2065/66	124,169	9,500	13	466,468	22,751	21	70,089	9,778
2066/67	162,276	10,150	16	612,505	18,311	33	55,782	6,710
6067/68	187,641	10,591	18	655,128	11,947	55	49,495	614

Source: NOC Ltd. Central Office, Kathmandu